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By PAUL H. DOUGLAS

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NO JULY BULLETIN

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This issue you are reading, larger than usual, is the July–August issue.

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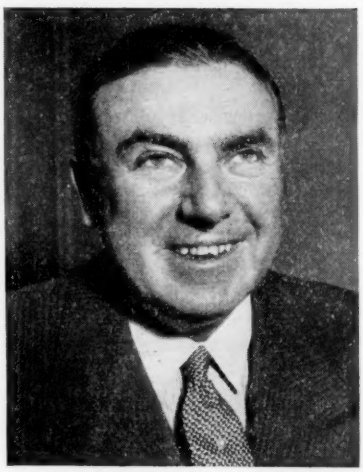
Senator Brien McMahon

ONE of the best friends science and scientists had in Washington, Senator Brien McMahon of Connecticut, died on July 28th. What appeared to be a painful and debilitating, but not dangerous illness, has revealed itself as a deadly cancer. He was a dying man when his name was placed in nomination for the Presidency at the Democratic National Convention—a farewell homage to a man whom vision, energy, charm, and integrity seemed to have predestined for the highest attainments. He was only 48 years old.

When, after Hiroshima, scientists descended on Washington to explain to all who would listen that a new era in human history had begun, and that a new departure in world politics was needed to meet its challenge, some listeners were bored, others incredulous, but the majority were impressed and many were convinced. Yet the convinced, like the incredulous, shook off the spell and went back to political business as usual. The young Senator from Connecticut alone could not forget. He persuaded the Senate to establish in October 1945, a Special Committee on Atomic Energy. He took this committee to school, with prominent physicists as teachers in the fundamentals of nuclear physics. He held long public hearings, unique in scope and intellectual level in American legislative history. The May-Johnson Bill, intended to perpetuate the secret military set-up of the wartime atomic energy project, died in this committee. McMahon drafted a new bill, establishing a purely civilian atomic energy authority. With the support of large groups of citizens, and of the overwhelming majority of American scientists, the McMahon bill became law on August 1, 1946.

The Joint Congressional Committee on Atomic Energy, provided by this law, has since become the principal organ of public scrutiny giving control, and direction to the vast American atomic energy project. As its chairman, Senator McMahon has devoted his exceptional energy and imagination to the task of comprehending the problems of the atomic age and seeking solutions for them. Without him, the Joint Committee could have easily degenerated—and may degenerate now—into a "watchdog" with little understanding of what it is watching over.

Senator McMahon, like most of his colleagues in Congress, was a lawyer; his rise in public life started when, as special assistant to the Attorney General, he put an end to violence in the notorious Harlan County. But unlike many other lawyer-legislators, his interest was in facts and ideas, more than in legal forms. He was one of the few politicians with whom scientists could find a common language. He understood the mainsprings of scientific endeavor, and the reasons why scientists are so eager to preserve open exchange of their experiences and ideas throughout the world. He encouraged scientists to take active part in public life. The editors of the *Bulletin* will not forget the hours they spent with him last October discussing atomic energy, atomic weapons, and world peace. They were impressed by his simple earnestness, quick intelligence, and fine sense of humor.



Wide World Photo

Senator McMahon had an unbounded enthusiasm for the potentialities of science for human progress; but he shared with scientists a deep apprehension of the capacity of science for destruction. He lived with two visions before his eyes—a bright vision of a golden era of plenty, and a bleak vision of an atomic war.

He believed that under the present world conditions, America had no choice but to develop to the utmost her strength in atomic weapons, including the hydrogen bomb; and he worked untiringly—and successfully—to push this development forward. But, unlike so many others, he did not forget for a moment that military strength, however overwhelming, can buy only an uneasy truce, and not lasting peace. He refused to admit that nothing could be done but to arm and wait. He wanted America to use the precarious peace, maintained by the balance of Soviet land power and American atomic bomb stockpile, to initiate new, decisive steps to break the deadlock and open the road to world cooperation. His mind was continuously preoccupied with the search for such steps; and he did not hesitate

(*Continued on page 201*)

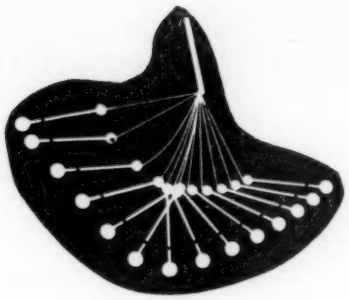
"Brien McMahon will be sorely missed. It is a cruel fate that the Connecticut senator should be lost to the nation just as the period of his training and testing was completed and he was ready for the big work of his life.

"No one can say now in what office he would have done best the work he was capable of doing. But, as a measure of what his reputation had become, I might say that I know of three men, disinterested and competent to judge, who—independently of one another—recommended him within the last two months as first choice for secretary of state if the Democrats won.

"He had achieved, they felt, the most important, indeed the indispensable, qualification for the office: He had earned political power on a national scale. He had used his political power to defend the principle of civil supremacy, and he had become the most effective exponent in Washington of informed and responsible resistance to the abdication of the civilian authorities."

—WALTER LIPPMANN
Chicago Sun-Times
August 1, 1952

Is It Wise To Use Uranium for Power?



HANS THIRRING

In the debate on atomic power—its costs and uses—here is a new problem posed by an eminent Austrian scientist: Is uranium too precious a substance to burn as fuel, as long as great untapped resources of power exist on the earth? Dr. Thirring is director of the Institute for Theoretical Physics at the University of Vienna.

SOON after the publication of the Smyth Report, voices arose warning against consuming the unique and precious material, uranium, in industrial power generators. Mankind still has at its disposal practically unlimited reserves of energy; only a tiny fraction of these resources has been tapped to date. Why then squander a material that has a key position in the world of nuclear transformations? Nuclear chemistry and isotope study are only in their beginnings; new, breathtaking vistas might open; new technical possibilities may appear—unless mankind has in the meantime foolishly destroyed the precious stock of fissionable materials.

Since then, warning voices have died down. To the contrary, we hear assurances from the highest authorities that no danger of exhaustion of uranium supplies exist. Lilienthal himself stated:

> Statements have been made and widely publicized that there is only enough uranium ore to last a relatively brief period, and so the prospects of benefit from atomic power must be glimmering. This is simply not so. It appears clear that atomic power is on a sound basis for an indefinite period in the future. . . . As explicitly as national security permits, the AEC wishes to state that it finds no basis in fact for these statements about extremely limited uranium ore supplies. . . . Instead, the contrary is true about uranium supplies. Estimated known reserves have already increased substantially since usefulness of uranium as a source of fissionable material became firmly established.[1]

There is no reason to doubt Mr. Lilienthal's statements. They are probably correct as far as construction of atomic power stations in our time and in the next three to five generations is concerned. But has anybody asked: how about later? I can well imagine that within a time that is infinitesimally short compared to the millions of years of future history of man, people will begin cursing the physicists and technologists of our own age for having erected, under the name of atomic power generators, Molochs destined to consume, year by year, ton after ton of irreplaceable uranium, until all economically worthwhile ores have been exhausted. It can easily happen that at some future time when our civilization will first have reached the advanced stage enabling it to start really going places with uranium and thorium, it will find left to it none but miserably poor deposits of these metals, while the rich ores will have been used up for production of industrial power—a commodity that can be obtained equally cheaply and conveniently from many other sources.

Lilienthal's assertion that "atomic energy is on a sound basis for an indefinite period" can reassure us that atomic power plants, once built, will not have to stop for lack of fuel, before their construction costs have been amortized. The Phoenicians, who cut down the cedars on the slopes of Lebanon, and the Venetians who deforested Dalmatia, could also have claimed to have acted as sound businessmen; and yet, two thousand years later, they stand condemned before history for having irresponsibly and selfishly robbed future generations.

If scientists of the twentieth century aspire to the reputation of enlightened and responsible men, the questions I am about to ask in this article should be carefully weighed and hotly discussed by bodies such as the AEC or the World Power Conference, before an irrevocable development is set into motion by the actual construction of atomic power plants. This trend will be irreversible because many millions will be invested in the building of atomic power plants; these plants will be operated, come what may, to repay the investment; and in so doing, they will consume, day in day out, atomic fuel in the form of uranium and thorium.

How Long Will Uranium Supplies Last?

Let us make a rough estimate of the time during which uranium can make a significant contribution to the world power supply. We find in an article by John R. Menke the following statement:

"World fuel consumption in all forms recently is equivalent to about 2×10^6 pounds of uranium per year. The full utilization of Uranium 235 and Uranium 238 which goes to make Plutonium is assumed here."[2]

In the United States, around one-third of total power consumption goes for the generation of electrical energy, the other two-thirds for heat production for industry and households. Let

[1] Sam Schurr and Jacob Marschak, *Economic Aspects of Atomic Power* (Princeton, 1950), p. 19.

[2] "Nuclear Fission as a Source of Power," *Bulletin of the Atomic Scientists*, IV (1948), 115–121.

(*Continued on page 205*)

The Universality of the Sciences

QUEEN JULIANA OF THE NETHERLANDS

Warning against over-specialization and the growing prestige of the expert was given by the Queen of the Netherlands in an address at Columbia University, where she was awarded an honorary degree of Doctor of Laws on April eighth. We here present the essential portions of Queen Juliana's remarks.

TO DEDICATE a life to knowledge and research is to choose one of the noblest and most responsible professions in our society; to dedicate some years to this, as a student, is a great privilege.

I know that the life of a university student, having been one myself at Leyden, is often very hard, and that the facts in it are hard. One may be an idealist; one certainly is also a realist nowadays. I also know that this life is very intense. This is a beautiful intensity, and I wish for you that you may keep it all your life.

By doing that you honor your university, those who taught you, and the career you chose.

To be a student at a university means to have lived in a small, but very democratic community. This is the very best school for the free development of all a person is worth, in mind and character, under constant comparison of his qualities with those of all the other students.

Well-trained, and imbued with this practical experience of democracy, the alumni thus enter society. It is up to them to spread the vitality of this experience wherever they go.

Knowledge opens the way to prominent places in human society. It does this for the individual as well as for the group, for the nation as well as for the group of nations.

The bearer of knowledge has to fulfil more demands, and carries greater responsibility. He has to stand face to face with truth.

As a scientist, he will know that there are new heights and depths of truth behind every new discovery.

And yet, although endlessly rich in facets, truth is a unity. The very word *university* avows this. However far the differentiation of science has proceeded, at a university, better than anywhere else, one remembers its ultimate coherence.

I believe that in the future an ever-stronger notion will develop of the fundamental unity of all spiritual life.

Already a new universality of the sciences is growing above the endless fission of the various branches. Thus the sturdy and undaunted search for truth is rewarded not only by an ever greater treasure of knowledge and skill, but also by an ever wider outlook on truth as the essence of life.

How vitally important this is!

The Trend toward Specialization

In every field of life there is a tendency to pin down, to classify, to make systems and catalogues and to strive after perfection, and so specialists are needed to look after every section of life.

I admit, the more the pattern of society has become complicated and interwoven, the more need there has been for experts. But here we meet the danger of mistaking details for essence.

We often forget that we, human beings, must not be only brilliant experts in highly restricted fields.

We become specialized so much that we are educated to become brains on wheels; you see brains carried by the wheels of the subway and you see brains behind big cigars, driving along in luxurious cars, carried by the wheels to their highly restricted jobs.

Anyway, minds with some very conventional and poor remains of a heart and, even less, of the soul; poor exploited experts.

People become so specialized and differentiated, that they are like the pieces of a jig-saw puzzle. By some centrifugal force they are shaken apart more and more, until they do not know any longer how they should fit into each other. They begin to wonder what on earth the picture was that they used to form together. They are in danger of becoming little objects with no purpose.

This means weakness for society. It is a form of disintegration; like a planet, which has become grit and dust, the substance has gone.

We have to stay, to be, to become something substantial.

Society must contain its purpose—life must have sense.

I think we all agree that man must think of his soul.

We owe the deepest gratitude to science and technology. They have been able to bring the greatest boons to humanity, and we may trust them to bring still more undreamed-of benefits and riches.

It is thanks to science that the whole world is within reach of everyone and that it is set on the path of global unity, showing all men that they should be one.

The perfecting of science, however, more than anything else, brings inevitably in its wake an ever farther reaching specialization and that is good in itself. But it is up to the human soul, heart, and mind to know, that they themselves are the origin and the goal, the beginning and the end of all the use we make of nature. Never forget, this earth is our playground, and it is not for nature to become our master and to cause our very strength and being to crumble.

If we do not follow our inner calling, we well may consider ourselves lost.

Our personal specialized skill is a wonderful tool to serve society and we should be grateful for it with all our soul—that soul, which is better equipped than anything else to look at the over-all picture of life.

After all, it is the heart and soul

(*Continued on page 206*)

Survival—the Real Issue of Our Times

BRIEN McMAHON

The threat of atomic war, the necessity of rebuilding the world so as to make such a war impossible and to prepare the country to meet it if it comes, have received scarce, if any, attention by the platform builders and convention orators in Chicago. Senator McMahon seemed to be the only American statesman of note who thought (and kept saying) that this is the most important problem confronting Americans in the present generation. As chairman of the Joint Congressional Committee on Atomic Energy, he was in a position to know what he was speaking about. The positive way in which he spoke of the hydrogen bomb as if it were an accomplished fact represents, to our knowledge, the first authoritative assertion of the success of the thermonuclear weapon project. As such, it is a statement of enormous implications.

Senator McMahon was not satisfied with reminding Americans of the threat; he also offered a two-point program to overcome it. First, he suggested that America must build hundreds of hydrogen bombs to prolong the period in which aggression can be prevented by threat of American retaliation; second, use this time to seek agreement with the Soviet Union on general disarmament and diversion of armament funds to finance world-wide cooperative plans for increasing productivity and reducing hunger and poverty. Some will dislike the first part of his plan; some, the second; but atomic scientists, at least, are unlikely to quarrel with Senator McMahon's diagnosis of the main problem of our time, and will support his conviction that it can be met only by bold and imaginative action on a world-wide scale.

TODAY we are face to face with decisions at least as momentous as the one President Roosevelt took, hardly ten years ago, when he decided to develop the atomic bomb. We are crossing the threshold into the hydrogen era—the age of H-bombs. . . .

It has been said that the tactical atomic bomb, although revolutionizing the defense of Western Europe, could not stop invading soldiers who advanced fifty yards apart. I do not think invading soldiers will advance fifty yards apart against the tactical hydrogen bomb. Neither do I think Stalin will order his Red Army to march against this weapon.

It has been said that aircraft parked around a base can be so widely dispersed that only a few would fall victim to the tactical A-bomb. I do not think that any aircraft parked near enough to a base for realistic operations could escape the tactical H-bomb. Neither do I think Stalin will send his Red Air Force against this weapon.

It has been said that naval ships in port would be anchored at such wide intervals that the tactical A-bomb could sink only one or two. I do not think the tactical H-bomb would sink only one or two. Neither do I think Stalin would risk his Red Fleet against this weapon.

Picture any military target, from ammunition depots to submarine pens, and from built-up areas to missile sites. In each case, I believe you will agree, and I believe Stalin will agree, the H-bomb could knock out such a military target more swiftly and surely and permanently than its forerunner, the A-bomb.

There can be no greater deterrent to war than our capacity to launch a countering offensive against the airfields and staging points and naval bases from which Stalin could launch an atomic attack against American cities and industry. We are told that vigorous and effective civil defense may reduce our casualties by one-half—a large percentage and yet a percentage not nearly large enough to deter Stalin from war. We are told that superb continental anti-aircraft defenses might intercept and shoot down as many as 30 enemy bombers in every 100—again a large percentage and yet again a percentage not nearly large enough to deter Stalin from war.

The H-Bomb as a Deterrent to War

If he should strike, our best and surest means of halting the blows against our cities lies in countering blows aimed at *his* atomic bases. This means an all-out counter-attack—a counter-attack compressed in time to the absolute maximum. Every day that an enemy atomic base were to stay in existence might mean a lost American city—a city that could be saved if the base were at once destroyed with finality. The hydrogen bomb, if available to us in quantity, could do this job as nothing ever before conceived by man could do it. The prospect would not be lost on Stalin.

Five years ago neither the professional soldiers nor the atomic scientists foresaw what will turn out to be the great military revolution—the use of atomic energy as firepower in the hands of troops, sailors, and airmen against enemy troops, sailors, and airmen. It was this revolution that brought about the requirement for great numbers of atomic bombs. No matter how many we might come to possess, we would need and could profitably use far more—in the event we were attacked. I feel very sure the

same will be true of hydrogen bombs—a conclusion which should be accepted now, not later.

There is a lead time in the development of tanks and guns and planes, and there is also a lead time in the development of military concepts and ideas. It seems to me perfectly obvious that the hydrogen weapon will have, in case of conflict, a revolutionary impact upon the conduct of war—by reason of its tactical uses. We must cut down the lead time in our thinking.

But I solemnly say to you: If we can build the H-bomb, Stalin can build it. If we can produce the H-bomb in quantity, Stalin can produce it in quantity. If we devote greater resources to the race for hydrogen supremacy, we will get there first. If Stalin devotes greater resources to the race for hydrogen supremacy, he will get there first. It is as simple and terrible as that.

Weapons no Guarantee to Peace

I must therefore emphasize that even great numbers of hydrogen weapons in our hands will never guarantee lasting peace. On the contrary, these weapons will merely serve to deter Stalin from war for an added period of years. They will merely permit us to stay ahead in the arms race for a longer time, and with less strain upon our economy, than would otherwise be possible. To build H-bombs, even numbered in four figures, is not in the least a solution. It is only another emergency stop-gap measure that will keep open the future for peace yet a little longer.

If I have said once, I have said a thousand times over the past half decade that, in history, arms races always lead to war. No sudden surge forward in the grim art of weaponeering can alter this historic lesson.

It should be obvious to all that, with the prospect of hydrogen weapons in large numbers—and probably on both sides of the Iron Curtain, the world crisis is entering a new and far graver phase. To my mind this is plainly a time to re-examine and to re-think the problem of international control over weapons of mass destruction.

Six long years have now elapsed since we went before the United Nations and offered to share with the world all that is good in atomic energy. We asked no special boon for our own country—except the boon of peace, which one and all would share alike. We asked others to accept no controls that we were not willing and eager to accept ourselves. We sought only to banish forever the evil in atomic energy and to harness its elemental power for the enrichment of human lives everywhere.

Again and again my thoughts go back to the stark assertion of our delegate to the United Nations atomic commission. On June 13, 1946, Bernard Baruch said—and I quote—"We are here to make a choice between the quick and the dead." That assertion is still the awful truth. It is still the awful truth even though the choice of the Soviet government has thus far been death, not life.

New Factors in the Problem of International Control

Yet there is the additional fact that six years have passed. In those six years important factors bearing upon the control problem have evolved and shifted.

At the time we first advanced our atomic proposals in mid-1946, the United States enjoyed a monopoly of the bomb. Furthermore, we had only a few atomic weapons, and the basic problem was then one of abolishing these few weapons and making certain that more weapons could not enter into existence anywhere on earth. Today the United States no longer enjoys an atomic monopoly. That monopoly was broken by the Soviet Union in mid-1949. Today, in addition, the United States possesses a very considerable stockpile; the Soviet stockpile is itself by no means insignificant in size; and a third country, Great Britain, is embarking upon the manufacture of atomic weapons.

In mid-1946 many of our planners assumed that uranium raw materials would remain scarce and severely limited. Many planners assumed that a handful of A-bombs—ten or twenty—could inflict paralyzing damage in a surprise attack. Many planners assumed that the atomic control problem must be considered separate and apart from the problem of regulating conventional weapons. Today, six years later, we know that uranium raw materials are plentiful, not scarce. We know that a handful of A-bombs cannot bring a major nation to its knees. And what is more, our thinking has evolved to the point where we now believe that control of atomic and conventional arms must be considered, not separately, but together.

In mid-1946 our proposals were carefully framed to take into account the possibility of hydrogen weapons. Yet, today, we know more about the technical aspects of these weapons than we did then. There is now hope, for example, that possibly there may develop, years hence, important peacetime applications of hydrogen principles. This all amounts, or may amount, to a basic change in the focus of the control problem.

I have yet to mention what may be the most vital change that six years has produced. This change may have been foreshadowed in an address which I had the honor of delivering before the Senate on February 2, 1950—at which time I proposed a plan for peace based upon fool-proof disarmament and the use of funds diverted from weapons to wage a world-wide war against human misery and want.

War on Weapons and Want

It seemed to me then, as it does today, that the only realistic way to conquer poverty lies in taking the huge resources which both the free world and the communist world now devote to sterile armaments and—through the United Nations—devote a big share of these same resources to helping hungry and sick and underprivileged people wherever found. Such a program of course means that the United Nations must control all armaments, in every country, to the point where violations would be impossible. Such a program of course means, in addition, that the Soviet Union must contribute to a United Nations world development fund the same share of the resources which it now spends upon armaments as our own country would contribute.

If these two conditions could be met, I estimated, when I addressed the Senate three years ago, the United States should be willing to make available five billion dollars per year for ten years or fifty billions all told. This money, matched by money contributed from Soviet Russia and from every country, would carry forward dramatically enlarged Point Four programs. This money would carry forward great projects to develop atomic energy for peace. This money would bring the suffering and the hungry bread and medicine and clothing and shelter.

I am human enough to remember

that, in early 1950, my proposal was derided by some as a global giveaway program. Today we are spending fifty billions, and more—not over a period of ten years to raise world living standards—but in one year, all for armaments that cannot feed or school or clothe a single underprivileged child.

A Fresh Look at the Control Problem

Today, in the United Nations, we advocate not merely disarmament but disarmament *plus* the use of weapons money for human advancement. Today, in the United Nations, we seek not merely the negative goal of banishing weapons but also the positive goal of substituting for weapons a better life everywhere.

We need, I think, a little group of dedicated men . . . to take a fresh look at the control problem. . . .

The new Commission, as I envisage it, would prepare a single detailed plan both for controlling weapons and for using the money saved to raise world living standards. The Commission, in other words, would plot the strategy and spell out the tactics of a combined war on weapons and on want.

Part of the job would consist in reviewing the technical requirements for regulating armaments. I tend to doubt that the Commission would find that our original atomic proposals can safely be revised in any of their essentials. But with the passage of six years and with the threat of hydrogen bombs running amok, I feel there is a moral duty to look again.

The main job confronting a new Commission would consist in proposing the terms and conditions and timetable whereby our nation could offer to take money saved from armaments and contribute it, along with the money of other nations, to a world development fund. What percentage of the fifty billions we now spend annually on defense would it make sense for us to consider allocating—after fool-proof disarmament had taken effect? Would a new United Nations agency be necessary to administer the world development fund? According to what standards would we ask other countries to make their contributions? These are some of the questions which I suggest need to be studied.

But if we are to take a fresh high-level look at the control problem, should we not call upon the Soviet government to do likewise? That government has forced us to amass our present atomic stockpile. Will it now inevitably force us to amass a hydrogen stockpile as well? I do not know whether the prospect of an arms race in H-bombs may help bring the men of the Kremlin to their senses. Yet again I feel that we have a moral duty to do every last thing within our power to find out. . . .

I would like to look forward to a meeting of the United Nations Security Council—a meeting to be attended by chiefs of state—a meeting called for the sole and single purpose of considering means of regulating all armaments and using portions of the money today poured into military budgets for bettering the lot of men.

A Platform for Peace

I would wage peace by appointing a Commission to re-think the twin problems of world disarmament and world development.

I would wage peace by delivering to Stalin a formal diplomatic note, calling upon him to appoint a similar Commission in Russia to formulate proposals for a concerted campaign both against weapons and against want.

I would wage peace by bringing about a meeting of the chiefs of state —within the United Nations Security Council—to consider ways and means of disarming this earth and developing this earth.

I would direct the United States Atomic Energy Commission to manufacture hydrogen weapons numbered in four figures. This would prevent war and win us time to wage peace.

I would direct that we substitute cheap atomic and hydrogen firepower for expensive conventional firepower. This would permit us to reduce taxes and balance the budget while we wage peace. . . .

Containment Alone Not Enough

Are there obstacles to the success of such a program? Yes—thousands of obstacles. Are there difficulties? Yes—and they are sharp and almost insurmountable. But I say to you that we will either get behind and push such a program or else we may perish.

A policy of merely checking and holding back the spread of communism solves nothing. This policy is negative. It is defensive. It is static. It does not keep either Russia or ourselves from building ruinous stockpiles of atomic and hydrogen bombs. Containment alone is not enough.

The program I have tried to present is positive; it is dynamic; it goes somewhere—and it meets head-on the root problem of competing stacks of atomic weapons rising higher and higher on both sides of the Iron Curtain.

I am fully conscious that many people will say that here is a man obsessed with a single idea. . . .

Each day in this political campaign we debate—with eloquence and often with passion—questions of real significance in one sense and yet questions which, when measured from the vantage point of history, can command at most little more than a footnote. It is our solemn obligation, I think, to lift our eyes above the lesser problems that seem to monopolize our time and to discuss and act upon what, by any standard, is the supreme problem before our country and the world.

Our children will little remember us for the political party we elect to office next November or even for the identity of the President we instal in the White House. Our children will little remember us for our views on this or that political issue, however important it may seem today. Our children will remember us according to how we met the issue of survival.

Based on an address delivered by wire from a Washington hospital to the Democratic State Convention in Hartford on June 14.

THE MILITARY BUDGET

Budget requests for next year:

President's budget, Jan. 21, 1952 for fiscal 1953 (71 per cent of the above for major national security programs.)	$84,260,000,000
Military services	52,359,000,000
Mutual Security Program	7,900,000,000
Total ($2,500,000,000 of above for economic aid, mostly related to rearmament.)	60,259,000,000
Interest on national debt (incurred primarily from military expenditures)	6,255,000,000
Veterans benefits	4,181,000,000
Available for all civilian purposes of Federal Government	13,565,000,000
Estimated deficit	14,000,000,000
Available from taxes for civilian purposes	—435,000,000

(The national security program figures given above do not cover the $1,255,000,000 budgeted for the Atomic Energy Commission, the extra cost of the war in Korea which is estimated at $5,000,000,000 for the last fiscal year, nor many other defense items to come in later. Neither does it include $3,870,000,000 appropriated in October 1951 for bases abroad.)

Nation's Business in February 1952 estimated that 87 per cent of last year's budget of $84,800,000,000 went for military purposes.

—"A Memorandum on the Ascendancy of the Military in American Life" in *Congressional Record* May 22, 1952

Biology and the Burden of Our Times

JEAN ROSTAND

In the following two articles, translated from the French, it is shown that progress in biology and surgery can confront the human conscience with decisions as momentous as any posed by the existence of the atomic bomb. Jean Rostand is a French biologist, author of L'Evolution des espèces, La genèse de la Vie, L'Avenir de la Biologie, *and other books.*

TODAY there is no science that does not hold out to mankind great hopes as well as grave dangers. Biology, the science of life, is not an exception. If its dangers seem modest in comparison to those of atomic physics, it cannot pretend to be all benign. According to specialists in military art, pathogenic organisms, able to produce large epidemics, could provide belligerents with a terrible instrument of destruction.

Even in time of peace, biology could help unscrupulous governments which do not hesitate to impose on people their ideology, or to eliminate bodily their adversaries. We recall the sterilizations ordered by the Hitlerites, their stupid eugenics, the treatments that have been used to obtain political confessions, and so on.

However, this possible collusion of biology with despotism and fanaticism is not the subject of our discussion here. Clearly, *all* progress, *all* achievements of spirit, *all* acquisition of knowledge, can be turned away from their original benevolent aims and employed for despicable purposes. All that has been created by man can be used against him. Thus, microbiology, whose original purpose is to combat infectious diseases, can be used to spread infection; psycho-surgery, developed to repair mental disorders, can be used to destroy personality.

The subject of our present article is different: to show how the progress of biology can become a cause of confusion and apprehension merely by affecting established equilibria, destroying certain prejudices, and confronting human conscience with unexpected and difficult problems.

In short, what we want to consider is not the malevolent use of biology, not its exploitation to unfair or criminal purposes, but the almost inevitable consequences of its natural evolution, consequences that could not be avoided even by placing the results of biological research in the hands of the wisest and most virtuous of men.

Until the last few years, biology had only one ambition, as far as man is concerned; to improve the physical or moral state of sick or abnormal persons. Its purpose was to correct, to heal, to restore the individual, to return him, by means of medication or surgery, to the fullness of his normal capacities. Its ambitions have now become much wider. Turning its attention to the healthy, the normal person, biologists ask themselves whether they could improve on nature. Who can fail to see the seriousness of this program, that means introducing into the play of natural forces —a mechanism that is undoubtedly imperfect, but has proved itself by its durability—all the uncertainties of the new and the artificial?

The Prolongation of Life

For example, biology does not consider it impossible to prolong the span of human life. It has had so far only limited success. By using certain chemical substances (mostly sexual hormones) a little vigor can now be returned, temporarily, to seniles. However, much more substantial successes may yet be obtained in rejuvenation; it is not unreasonable to imagine that our life span may be doubled or tripled. Undoubtedly, this will satisfy the instinct for survival which is so strong in all of us; but what will be the consequences of this change for the community? What will happen to a nation, or humanity as a whole, encumbered by macrobites; to a society in which the renewal rate will be artificially slowed down? One conceives that, in any case, serious adjustments will be needed to permit society to accommodate such a plethora of the aged—in particular, to avoid permitting the obnoxious persistence of certain individuals.

The Voluntary Determination of Sex

In the same way, we hope that biology will solve the great problem of the voluntary determination of sex; in fact, its solution appears not too far away, considering the state of our knowledge concerning the natural mechanism of this phenomenon. It is easy, however, to foresee that this new feat of biology will cause much trouble. Under natural conditions, the number of new-born boys equals approximately that of new-born girls (106 boys born per 100 girls); this equality is brought about not (as people once believed) by a decree of Providence, but by the free interplay of the laws of large numbers. The determination of sex occurs at the time of conception, and is accidental, in the sense that the chances for the formation of a male or female embryo are approximately equal. For a very large number of births, the chances become equalized, and this leads to the observed constancy of the ratio between the two sexes.

What will happen on the day science will have given us the possibility of determining the sex of our offspring according to our desire? Will the human desires and individual preferences compensate and neutralize

each other—as blind chances do now? Or will the equilibrium be shifted in favor of one of the two sexes? If the dicrepancy in the numbers of males and females should become too extreme, will not the state feel itself obliged to intervene and to restore the natural harmony, which human will, assisted by technology, will be about to destroy? So much from the point of view of society. From the point of view of the individual, will it not be a heavy responsibility upon the parents (which, incidentally, will not always be of the same mind), to have to choose the sex of their child? Was it not much easier to rely on unpredictable chance?

Virginal Procreation

Another innovation appears close at hand, *parthogenesis* (virginal birth).

In the laboratory it is already easy to obtain fatherless offspring from many invertebrate animals—sea urchins, silk worms—and also from frogs and toads. Some have even been obtained from rabbits. Why not, tomorrow, from women?

The idea of virginal procreation will encounter strong resistance on the part of the Church. (The Church, as well as the French Academy of Moral and Political Sciences, has already condemned artificial insemination!) It is not the question whether this method deserves recommendation; it is self-evident that the natural way will always remain preferable. However, once science has established the feasibility of virginal procreation, it will become impossible to prevent some women from taking recourse to it—either because they feel repugnance toward the opposite sex, or because, having found no husband or lover, they might prefer parthogenesis to artificial insemination.

It is thus inevitable that a new kind of human being (according to our present knowledge, they will all be girls!)—will appear in society, and will be aware of their extraordinary origin. Even though this method may remain restricted to exceptional cases, the very fact of its existence, the realization of the fact that the male has ceased to be necessary for propagation, will not fail to exercise a profound effect on the relations between man and woman, and on the whole sexual psychology; not to speak of changes in legislation which will become necessary because of the existence of virgin mothers.

We may also mention in passing the modification that biology may one day introduce into childbirth: perhaps, the day will come when women will be liberated from the chores of pregnancy, and the development of the child will be carried out entirely in the incubator (*ectogenesis*).

Therapy of the Spirit

The most worrysome consequence of the progress of biology is, however, in our opinion, the possibility of artificial modification of the intellectual and moral characteristics of a person.

We know that hormones—chemical compounds released into blood by the endocrine glands—exert a powerful influence on the psychic traits of man. Robert Courrier (in a lecture delivered in 1927 before the combined session of five Academies) said: "Mental life can be strongly influenced by hormones, and recent textbooks of psychology devote considerable attention to this phenomenon." Certain types of cretinism and turpitude, of asthenia and depression, of excitability and impulsiveness, undoubtedly are of hormonal origin. The thyroid, the adrenals, the gonades, and the pituitary, all play their role. American statistics show that in some reform schools, 20 per cent of the children show endocrine disturbances. This poses a delicate problem of human responsibility.

There is only one step, from this finding, to the discovery of hormone-like substances that could make a person more intelligent, more inclined to be good to others, to behave in a more social way, or to be more courageous. The whole concept of intellectual and moral merit will be put in question by such a discovery. What would be the worth, in our eyes, of an artificial virtue, brought about by chemical means, or of courage obtained by injections?

One could ask similar questions about modifications of personality that could result from adroit surgical intervention, or from chemical or electrical treatment of the brain.

One has to acknowledge that this "therapy of the spirit" will pose rather uncomfortable dilemmas. If, tomorrow, biology should provide us with a remedy against worry, if it should find itself capable of curing metaphysical anxiety as it cures seasickness, would we accept the benefit of such sedatives? Will we not be afraid this way of pacifying the human being may take away from him a powerful source of activity and inventiveness—perhaps, even some of his nobility?

Compulsory Eugenics?

If biology should soon acquire such power over the individual, it may become no less powerful over the race. We already know, with considerable precision, the mechanism of the hereditary transmission of many deficiencies and illnesses. We know that certain combinations of parents are dangerous for the progeny; in a certain marriage, the child may have one chance out of two of being born with a certain malformation or defect. Does not this foresight lead to a right, if not a duty, for the state? Is not the state entitled, in the interest of future generations, to interfere in such cases in the essentially private affairs of marriage and procreation?

We have thus come to the grave problem of compulsory eugenics.

Legal sterilization of people suffering from certain grave deficiencies is practiced in many countries, including the United States, Switzerland, and Denmark. Valid arguments can be adduced in its favor. Why permit the bringing into the world of sufferers, of misformed persons, incapable of happiness, who will become a burden on the community? On the other hand, this infringement upon the integrity of the person offends our respect for the dignity and freedom of the individual. And, then, have there not been great men among the defectives? Beethoven was deaf; Byron had a club foot.

Even more uncomfortable are problems raised by so-called "positive" eugenics. The latter aims at elevating the human race by systematic selection of male germ cells. As the famous American geneticist, H. J. Muller, has shown, all that would be needed for this purpose are certain procedures developed in the practice of artificial insemination (at the utmost, dilution of the semen). This would be sufficient to give superior individuals, "men of genius," a very numerous offspring.

Whatever reservations are necessary in respect to hereditary transmission of talents and intellectual capacities, it is probable that, statistically, such measures will have favorable results: in a few generations, the number of superior individuals will show a marked increase. Can one doubt that this is a desirable development—even though an eminent biologist, Rémy Collin, has asked whether "it be necessary for the happiness of mankind that the streets should teem with geniuses." Collin is worried lest any violent change in the genetical composition

of mankind lead to misery and ruin of the human race.

In any case, all attempts to carry out such brutal measures of human selection would encounter, at the present time, insurmountable social and moral difficulties.

The Creation of Superman

There is, finally, one grandiose possibility—the most grandiose of all—which we have no right to neglect. In plants and in animals, biology already has created new races, or even new species, superior to the original ones. Why should we not succeed in creating a man superior to the present species—a "superman."

It is impossible not to be thrilled and tempted by the prospect of the emergence, from man, of a creature exceeding him in intelligence and power; a creature destined to solve problems that baffle us. On the other hand, will not our instinct of self-preservation revolt against the advent of this stranger, before whom man will have to bow and efface himself? Will this superman inflict on man "the supreme insult to human narcissism," as Dr. Parcheminey said of Death? In fact, this ultimate success of man will mean the self-inflicted death of humanity!

The Choices before Us

We have given but a very cursory review of the multiple repercussions which the development of biological techniques may produce in the state of mankind. This review is, however, sufficient to show the seriousness of the situation. It well deserves the anxiety of those traditionalist minds, who are afraid to see men approach Man with their clumsy, big hands. Speaking in the name of religion, Rémy Collin vigorously denounced the menace of the "naturalistic slide," which, he surmised, "might only too easily lead into bottomless abysses."[1]

"The discrimination between what is and what is not morally permissible is not always easy," says Collin. This is undoubtedly so; and if this discrimination is difficult to those who, like Collin, have the standard of a divinely revealed morality to go by, and who attempt to be guided by the "supreme and ultimate aims" assigned to man by his Creator, how much more difficult should it be to those who see in man only the highest of animals, having no other duties but those to himself, or to values he has himself established!

For those men, decision will be possible only on the basis of certain agreed moral postulates. One might decide to strive for the "greatest happiness" or "highest dignity" of the individual, for the "most harmonious" or "most productive" society; or for highest humanity—humanity most capable of evolving superman.

However difficult the choices may be, however grave the embarrassments into which the necessity for making these choices may bring us, they are the inevitable price to be paid for our growth in knowledge and power. All increase in human capabilities complicates the moral life, since it imposes the duty to choose between use and abstention.

Let us beware, however, of ever reproaching science for the difficulties it has created for us. It is not recent news that living is more arduous for an adult than for a child.

[1] "The Human Personality in the Face of Biological Techniques," *Source*, 1950.

Neuro-Surgery and the Problems It Raises

CHRISTIAN FAVRE

NEURO-SURGEONS now dare to undertake the most radical interventions into the cerebral matter. We all know that for ten years, lobotomy (an operation that consists in severing the fibers connecting the cerebral rind to the thalamus) has been used to treat certain depressive states. In 87 per cent of such operations, the patient has been relieved of excessive emotional tension; but *all* "lobotomized" persons have lost their initiative and their fighting spirit.

In the face of such changes of personality, the surgeon and the layman alike are seized by apprehension. That a small surgical intervention—it doesn't even leave a visible trace (since the knife cutting the fibers can be introduced through the orbit without leaving the slightest scar)—can change so radically the emotional and social make-up of a human being, poses one of the most difficult problems which man has confronted. That this operation can be performed in a few minutes on an anesthetized person who will never even suspect what has been done to him (unless somebody tells him about it) leads to gravest apprehensions. We see surgery becoming a potential plague of mankind.

Can we envisage, without revolt and anxiety, the possibility of a dictator's being able to transform—without anybody knowing about it—the most intrepid of his opponents into meek individuals subservient to his authority? In the face of the incomprehensible attitudes of certain political and religious personalities, previously known for their courage, it has already been asked whether the true reason for their submissive behavior could not have been a "benevolent" strike of the surgical knife. The mere fact that such a question *can* be asked is sufficient to enrage an honest man.

Even without admitting that such monstrous acts can be committed now or in the future, one must ask, in observing the achievements of neuro-surgery, what the latter will do to the man of tomorrow. Already, the neuro-surgeon, exploring the brain with the tips of his electrodes, can cause the patient to hear, at will, strident or melodious noises, to see dreams which the surgeon is almost able to forecast, to sense smells, or to lose his speech.

True, it is not through sadism that the surgeon "plays" in this way with his patient. He is looking for the precise location of a lesion causing organic damage or psychic trouble. Nevertheless, this intrusion into the most intimate and mysterious areas of the individual causes apprehension.

Psychoanalysis—another discovery and, perhaps, another *malaise* of this century—has made a lightning ascent in the last few years. It is easy to ridicule the psychoanalysts; but this doesn't detract from the fact that people consult them more and more often. One tries to imagine what would have been written by a Verlaine released from his complexes, by a Rousseau whom surgery had liberated from his anxieties, by a Chateaubriand made free from the memory of that blythe and Freudian spirit, the charming Lucile.

Decidedly, the progress of physics, mathematics, and biology are not the only sciences responsible for the *malaise* of the century: medicine has its part in it.

Translated from two articles in the French review, *La Nef*, June–July, 1951, and used here with the kind permission of the publishers.

Scientists and the Federal Government

E. U. CONDON

How the U. S. government both supports and obstructs American science and scientists is discussed in this article by the former director of the U. S. Bureau of Standards. Dr. Condon has now left government service to become Director of Research for the Corning Glass Company, Corning, New York.

THE topic, "Scientists and the Federal Government," is an important one because, each in their own way, both science and the federal government play dominating roles in our lives today. Therefore, the interactions between them must necessarily be of profound interest to us. I suppose that, for better or for worse, it will be a long time before we live again under circumstances in which either organized scientific research, or the actions of the federal government, will affect our lives as little as they did, say, a half-century ago.

We are faced with some very serious and difficult problems in this as in many other areas. I want to discuss some of these in the hope that what I say will help clarify your own thinking.

The Scientist and His Conscience

What are scientists, and what do they do? Scientists are persons who devote themselves to planned and controlled study of natural phenomena with the object of increasing our understanding of the world in which we live. Many of them are principally motivated by the thrill and excitement of doing this. Many more derive a deep religious satisfaction from the scientific study of nature; it is one way to know more of the Creator, to devote oneself to a study of what He has created. Others are motivated by the useful applications of the understanding of nature which science gives us, with varying degrees of concern about whether these applications produce good or evil results in the use which society makes of them.

These additional considerations of motive are foreign to science as such. A man is a good scientist if he makes honest and effective use of the techniques of planned and controlled study of nature, without regard to his deeper personal motives for doing so, and also without regard to what use he or others may make of the knowledge so gained. In this sense science as such is ethically neutral. But the scientist is also a human being with responsibilities to God, and in this sense must be concerned with the social conditions in which he lives and in particular with society's attitude toward science, and the use his community makes of the results of science.

Scientific research is supported by individuals, industrial and governmental groups, partly out of a genuine desire for abstract knowledge, but mostly from the desire to make some sort of use of the results obtained. We live in a world of vocational specialization and today most scientific research is carried on by full-time professionals who are employees of others.

Individual and Group Responsibility

This fact immediately raises some ethical questions. Suppose a scientist is employed by his government to work on some matter which is revolting to the consciences of most of us, let us say, on techniques of offensive bacteriological warfare, to be blunt about it. Suppose he is eminently successful in developing effective techniques. Suppose his government uses them in warfare. Is the scientist who made this possible particularly reprehensible? Or is not the guilt for the evil done shared by the social group as a whole, or, more particularly, by those officers of government who made the policy decision which set the scientist to work on this task?

We come here face to face with a kind of question to which different men's consciences will give different answers, just as different individual Christian pacifists will permit themselves varying degrees of involvement in military affairs.

My position on this is definite: When society, or more particularly the government of any national group, equips laboratories and sets men to work on development of new weapons of any kind, the moral responsibility for this act must be assumed by the group as a whole, and cannot be put on the shoulders of the individual scientists who are assigned to such work.

I want to emphasize this point strongly because I feel that science and scientists are beginning to suffer in general public esteem because they are being so largely employed in recent years in military weapon development. I think there is a basic public conscience which is disturbed at the prospective use in warfare of ever more terrible weapons, and in a shallow unthinking way the scientists are beginning to be blamed for these things. If they do their work well and produce the results we have asked them to produce, and then we do not like the result, is this their fault or ours?

I maintain that we are all in this together, and that neither society as employer nor scientist as employee can escape the moral responsibility attaching to their acts.

There are many signs that this point is not well understood. In the April issue of the *Bulletin of the Atomic*

Scientists, General Omar Bradley is quoted, I would hope incorrectly, as having said:

> We have too many men of science, too few men of God. We have grasped the mystery of the atom and rejected the Sermon on the Mount. . . . The world has achieved brilliance without wisdom, power without conscience. Ours is a world of nuclear giants and ethical infants. We know more about war than we do about peace, more about killing than we do about living.

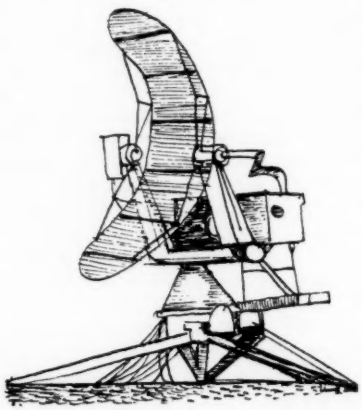
Here is a striking example of the mistaken antithesis between science and God. We are not confronted with the choice that is implied here: One can be a man of science and also worship God; one can grasp the mystery of the atom and even more fervently strive to follow the teachings of the Sermon on the Mount; one need not be an ethical infant because he is a nuclear giant.

The *Bulletin* does not give a reference to the occasion on which General Bradley supposedly made these remarks. I presume it was not when he had to appear before the House Appropriations Committee in support of the military budget for fiscal year 1953.

Government Support of Research

It is difficult to learn from a study of the federal budget, as sent up to Congress, just what our government spends in support of scientific research. This is mainly owing to the fact that research and development are lumped together as one category. Developmental expenses are always so much greater than research costs, and the boundary line between them is so arbitrary, that one cannot easily separate the two. A table on page 107 of the April *Bulletin* estimates for 1953, that the total federal obligations for research and development will be $2,589 millions, of which $2,038 millions are for the military functions of the Department of Defense. But this does not represent all that is intended primarily for military purposes because, as every one knows, most of the $265 millions allotted to the Atomic Energy Commission and the $84 millions for the National Advisory Committee for Aeronautics, is directly contributory to military purposes. Thus we see that some 92 per cent of the federal research and development budget is for military matters.

What about the National Science Foundation? This is the new agency on which we pinned our hopes for some federal aid to basic scientific research in our universities, and to assist in training more scientific research workers—without which, by the way, it will be impossible to staff these enormous military development projects. The National Science Foundation was down for some $9.7 millions of estimated obligations in 1953. But I understand that Congress has reduced this paltry sum—about a third of what a civilian agency like the National Bureau of Standards will spend this year on military electronics development—to $4.75 million. This great nation will spend more than $2,300 millions on military research and development, but economy preachments in Congress in an election year will dictate that what our federal budget gives to basic science will be cut from a hoped-for 0.4 per cent to less than 0.2 per cent of the military research budget!



Such a gross neglect of the mainstreams of basic knowledge is disastrously foolish, even from the viewpoint of those who believe that future military security of this nation requires the diversion of most of our scientific manpower to military research. One could increase the budget of the National Science Foundation by 1,000 per cent by diminishing the military research and development budget by less than 5 per cent. Such is the disparity in funds made available by Congress for different areas of scientific work at a time when the Chief of Staff of our armed services can be quoted as saying that, "We know more about war than we do about peace, more about killing than we do about living."

No wonder that scientists find it increasingly difficult to find professional employment that is not related to this all-engulfing effort, and no wonder that the public mind more and more associates science mainly with the development of fantastic new weapons. There is a serious unbalance here which is not good for science nor for scientists nor for the future welfare of our country.

The Attacks on Loyalty

I turn now to another matter in which the relations of scientists to the federal government stand in great need of improvement. I refer to the dishonest political attacks on the loyalty and integrity of scientists and others in the federal service which have been loudly exploited by a few irresponsible members of Congress. I call these dishonest for I think that in many cases speeches have been made in which the speaker not only did not have evidence to support his charges, which would be bad enough of itself, but was cynically quite well aware of the fact that he did not have such evidence at the time the speeches were made. How else can we explain the failure of these men to follow up their attacks? Not to do so, if they sincerely believed what they say in such speeches, is as serious a breach of responsible conduct, as are the things of which they falsely accuse others.

In 1947 and 1948 the House Committee on Un-American Activities made great efforts to show that some of the staff of the Radiation Laboratory of the University of California had not properly safeguarded confidential information to which they had access in connection with the atomic bomb project. A great deal of investigating was done both by the FBI and by the Committee's own staff. Unfavorable publicity was given to several of these people, with the result that some of them lost their positions in universities. Yet nothing ever came of this that was worthy of presentation in court.

These things caused a great deal of personal suffering to those involved, suffering and loss of professional opportunity, which still goes on for several of them. One very able cosmic ray physicist has had to turn to potato growing in Colorado; another gifted young theoretical physicist lost his university position but secured another one in Brazil. Another cosmic ray physicist was so hounded that he has left America and emigrated to India.

The damage to science and the federal government's position in science

goes far beyond the sufferings of these individuals. Largely as a consequence of this and other incidents, the federal government has set up a vast machinery for investigating all of its employees. I do not question the right of the government to try to assure itself of the trustworthiness of its employees, especially those who are entrusted with confidential information. But I do object to the ridiculous extremes to which this task has been pushed in the hysterical atmosphere of the last few years.

This has resulted in a great deal of needless suffering on the part of obviously decent individuals, has driven many such persons out of federal service, and has caused many others to show a great reluctance to enter federal service under present conditions.

It is difficult to give specific examples because many people who have gone through such experiences do not wish to have told what happened to them. In a recent speech I told, in a way that was well camouflaged, about a case which seemed particularly outrageous to me. A few days later this man wrote me a letter asking me not to mention his case again even anonymously, as he was afraid it might result in more trouble for him.

Cases of Injustice

But there are many cases which can be told. The wife of a distinguished American scientist who had a minor computing job was put through months of nervous anxiety. She was charged with (*a*) intimate association with her own husband, against whom no charges have been made and (*b*) carelessness in handling classified documents. She was guilty of the first charge, being the mother of five children, but as to the second she was able to prove that in her work she never had any occasion to handle classified documents. Eventually she was cleared, but she suffered months of nervous worry, and a not inconsiderable legal expense.

We have a constitutional principle which says that no one shall be placed in double jeopardy, that is, tried twice for the same offense. But this principle is not followed in the government's so-called loyalty program. A year ago the President was persuaded to change the rules so the government need only show "reasonable doubt" of a man's loyalty instead of establishng grounds of belief that he is disloyal. A few weeks ago I learned of a government scientist being dragged through a second loyalty hearing, after having been cleared a few years ago. This person, during the war sublet his apartment in Chicago for a few weeks to Alan Nunn May, as an act of courtesy to this visiting British scientist. The government found several years ago that this did not establish disloyalty but is now going through an elaborate procedure again to see whether it may show "reasonable doubt."

I heard of a labor expert who was put through a loyalty hearing in Washington on the charge that when he was in Japan he had shown a great interest in communism. Actually he had been employed by our occupation government there to work to diminish the influence of communism in the Japanese labor movement and was officially commended for his services on that assignment, which naturally had re-

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Free Speech for the "Red Dean"

Mr. Langford-Holt (Shrewsbury, C.) asked the Prime Minister if the Government would move in both Houses of Parliament for the establishment of a tribunal to inquire into a definite matter of urgent public importance—namely, the behaviour and conduct of the Dean of Canterbury in furthering and disseminating the propaganda of persons engaged in hostilities with British troops and in claiming that he had proof of the truth of such propaganda.

Mr. Churchill—The establishment of such a tribunal would in the opinion of the Government invest the activities of the Dean of Canterbury with an importance they do not possess. (Cheers.)

Mr. Langford-Holt asked if the Prime Minister was aware that, while no one would seek to prevent the Dean as a private individual expressing views he had a legal right to hold, there was a cause for dismay to millions of people living behind the Iron Curtain, believing as they did that he spoke on behalf of the Church of England. There lay the danger.

Mr. Churchill—We all see these difficulties, but there are other difficulties in taking special action, and the idea of setting up a tribunal upon an individual in the circumstances for exercising—or abusing—the rights of free speech, which we are all resolved to defend, would be almost endless. (Opposition cheers.) We really must keep a sense of proportion and not add to the harm that has already been done. (Cheers.)

Colonel Gomme-Duncan (Perth and East Perthshire, C.)—Would the Prime Minister consider sending this pathetic figure to a psychiatrist? (Loud laughter.)

Mr. Driberg (Maldon, Lab.) asked if the Prime Minister realized that the logical consequence of the pressure to which he had been subjected from the benches behind him would be a demand from the Church of England for disestablishment. (Ministerial laughter.)

Mr. Churchill—I think we might all easily get into depths beyond that we wish to dabble in today by going further in this matter. (Opposition cheers.) Free speech carries with it the evil of all the foolish, unpleasant and venomous things that are said, but on the whole we would rather lump them than do away with them. (Loud cheers.)

—Debate in the British
House of Commons
July 16, 1952

quired him to "show a great interest in communism."

To those who defend these matters by saying that the government must take steps to protect itself against spies, I reply that these procedures have caused a great deal of damage to the federal service, and they have not caught a single spy. I do not know whether there are any to be caught, but I am convinced that the government's so-called loyalty program is not likely to catch one.

So many stupid errors have been made in the administration of these matters, and so many decent people have been harried and harrassed, that you must not be surprised if some day you or one of your friends gets caught up in this bureaucratic foolishness. If so, it can be helpful for you to know that many decent people before you have been dragged through such an experience and with the help of loyal friends, have survived it. If you are accused, do not be unduly discouraged, and if a friend is accused do not be afraid to come loyally to his or her assistance.

The Passport and Visa Situation

Finally, I would like to discuss one other area in which I think the federal government is taking actions which not only affect science and scientists adversely, but which also have a bad effect on the whole "public relations" position of America in relation to the peoples of other countries. It has been said that "not only does the left hand not know what the right hand is doing, but it is busy undoing it." I think that this could be fairly said of the over-all effects of some of the ways in which the Department of State is handling visa and passport matters affecting scientists.

I refer to the action of our consular officials in denying, or at least greatly delaying, the issuance of visas for visits of scientists from abroad to this country, and also to the action of the Passport Division of the Department of State in stopping or greatly impeding foreign travel by American scientists. With regard to the obstacles to travel of foreign scientists here, the State Department is, of course, obliged to enforce the McCarran Act which was passed by Congress over the President's veto. With regard to obstacles to foreign travel of American scientists, this is entirely due to policy of the State Department's own making, so far as I have been able to determine.

Some Americans who apply for a passport get it in a week or so. In the case of others, its issuance may be delayed for months, until the occasion for the trip is passed, and then the passport may be issued when the applicant can no longer use it. Apologists for the State Department do not like you to say that the passport was denied in such cases, that is why I call this, less specifically, "obstruction" of foreign travel.

Also these apologists like to point out that the law does not require the issuance of a passport to any American citizen. That is true, but this situation dates back to simpler times when one could travel freely in most parts of the world wthout need of a passport, so the lack of one was not an obstacle to foreign travel. I think that nowadays, when it is essentially impossible to travel abroad without a passport, most people would feel that it is unfair to deny one to a citizen by an arbitrary administrative action, and that if the government finds it necessary on occasion to restrict foreign travel of its citizens, that the principles governing denial of passports should be publicly known, and that an applicant should have some procedural opportunity to defend himself against a ruling which denies him a passport.

Within the last year, quite a number of distinguished European scientists have been denied admission to the United States, even for brief periods to attend scientific congresses. Even where visas have finally been granted, there have been numerous cases of very long delays which greatly upset the indvidual's plans.

I am told that one branch of the armed services wanted last summer to hold a research conference on problems of upper atmosphere research to which several important French leaders in the field were to be invited. However, it was feared that these scientists could not get visas to enter the United States, so the conference was held in Canada where no McCarran Act exists.

[1] This report will be reprinted in the September issue of the *Bulletin*, which will be devoted to the scientist travel situation.

The FAS Report on Travel Restrictions

This whole matter was recently the subject of a report to the Federation of American Scientists, prepared by a committee headed by Professor Victor Weisskopf, of the Massachusetts Institute of Technology.[1]

The report makes the points that the policies we are following are (*a*) damaging to American science, because we can no longer play host to international congresses, and we are cut off from first-hand contact with ideas from abroad; (*b*) damaging to science in Western Europe, because their scientists are deprived of the stimulus of contact with our work; and (*c*) damaging to the general cultural position of the United States abroad in that people in Western Europe can no longer believe that ours is an open country having no Iron Curtain, in contrast to Russia. The report further says: "The type of questioning and the grilling which accompanies our present visa procedures has been compared by many foreign scientists with similar methods used under the Nazi occupation or used by the Soviet bureaucracy."

These are the main points I want to make. It mainly comes to this: (1) that society has as much responsibility as scientists for any evil use it may make of the results of science; (2) that we are making a disastrous mistake in giving so little support to fundamental research while spending vast sums for military research programs; (3) that the way in which the loyalty investigations in the government are handled is unfair, un-American, and detrimental to the federal service; and (4) that our relations with foreign scientists are being impeded, thus damaging both science and our own prestige as a free country.

It all adds up to a pretty bad picture. But we do not need to be completely downhearted. We as citizens are free to discuss and debate these questions among ourselves, and in this way eventually a better situation will prevail. As long as we retain and exercise our basic responsibilites as free citizens, in spite of the efforts of some of our politicians to coerce and intimidate us into silence, we can have faith that these difficulties, however unpleasant and even dangerous they may be now, will be overcome.

Based on a speech delivered at Washington University, St. Louis, Mo., on May 13, 1952.

Russian Science Symposium:

VII

Bolshevik Principles and Russian Physiology

W. HORSLEY GANTT

The following article, based on a report to the AAAS symposium in Philadelphia last December, is written by the director of the Pavlovian Laboratory of the Phipps Clinic at Johns Hopkins University. Dr. Gantt first visited Russia with the American Relief Administration in 1922. After a year of this work and another year in London, he returned to Russia and worked with Pavlov until 1930. He visited Russia in 1933 and again in 1935. He is the author of two books on Russian medicine, a biography of Pavlov, and is the editor of Pavlov's lectures.

CONTEMPORARY Bolshevik physiology should be evaluated in the light of Russian history and culture as well as of the present environment. If one interprets happenings in Russia from the viewpoint of one of the Western democracies, with its long and hard-won traditions of emphasis on the rights of the individual, it is very difficult to arrive at any comprehension of the present events. To try to understand the Russians except against their own background and historical position leads only to confusion.

Russian Medicine before 1918

Russian medicine got off to a late start three hundred years behind medicine in Western Europe. It had its real beginning under Peter the Great, who not only founded the first hospitals and universities, and created the Russian Academy of Sciences, but himself studied medicine in Holland, along with his apprenticeship as a common laborer in ship-building, and performed surgical operations on unwilling subjects on his return to Russia. After the forceful introduction of medicine into Russia by this vehement monarch, the subject languished until the modified Renaissance which overtook Russia in the middle of the nineteenth century. In the next hundred years, although there were only a few good medical centers in Russia, medical progress was fairly rapid, and several world-famous scientists appeared for the first time in Russian history. Among these were such names as Mendeleev in chemistry, Botkin in pharmacology, Pirogov in surgery, Sechenov, the "Father of Russian Physiology," Von Baer in embryology, Korsakov in psychiatry, Pavlov, the first Nobel Prize winner in medicine, Mechnikov in pathology, Bekhterev in neuro-anatomy and psychology, Tarasevich in public health. During this period Russian medicine was advancing along parallel lines with that of Western Europe, although it was characterized by its own unique type of development.

Contributions to Neurophysiology

Pavlov, son of a Russian priest, and a theology student himself, was the first Nobel Prize winner in medicine (1903). His scientific work falls into three periods: (1) researches on the circulatory system (1878–88), (2) researches on the physiology of medicine, and (3) investigation of the higher nervous activity. In the first period he was the discoverer at the same time as Gaskell of the trophic nerves to the heart. He also made blood-pressure measurements of the intact and normal animal's response to emotional stimuli. He discovered the secretory nerves to the pancreas, devised the method of the chronic fistula and the Pavlovian miniature stomach (in which the vagal nerve branches were preserved). The important principle that he introduced was that of surgical asepsis in the physiology laboratory, and the chronic experiment for the acute, in which the animal was studied over its life span under nearly normal conditions. From 1900 until his death in 1936 he investigated the physiology of the supra-segmental nervous system by the method of the conditional reflex. In the last five years of his life he attempted to apply the principles of the animal experiments to human psychiatry.[1]

Both Pavlov and Bekhterev had large laboratories in Petrograd. Orbeli, Babkin, Bykov, Volborth, Anokhin, Kupalov, Andreev, Podkapeev, Ivanov-Smolensky, and Krasnogorsky —all were prominent pupils of Pavlov. Anokhin has worked at nerve transplantations, effects of regeneration on behavior, and the changes of patterns of behavior with growth. In the advances which he made in the field, he employed the ideas of foreign physiol-

[1] His life and work and his researches on the nervous system are described in: Pavlov, *Lectures on Conditioned Reflexes*, ed. W. H. Gantt (New York: International Publishers, 1928); and *Conditioned Reflexes and Psychiatry*, ed. W. H. Gantt (New York: International Publishers, 1941).

ogists, e.g., Adrian and Sherrington.

Sechenov (1829–1905) is the Father of Russian physiology. He studied abroad with DuBois-Raymond, Hoppe-Seyler, Ludwig, Bunsen, and Claude Bernard, in whose laboratory he conceived the bold concepts outlined in his *Reflexes of the Brain* (1863). In this volume he asserted:

> All movements known in physiology as voluntary are reflex in the strictest sense of the word. The outstanding feature of the normal activity of the brain (as expressed outwardly in the form of movement) is disproportion between excitation and effect (movement). The reflex activity of the brain is more extensive than that of the spinal cord.

These ideas were the forerunners of Pavlov's conditional reflexes. Sechenov discovered central inhibition, and his pupil, Tarkhanov, the psychogalvanic reflexes. Other great medical figures of this era were Vvedensky, Mechnikov, Botkin, Bekhterev, and Danilevski.

Krasnogorsky has employed the salivary method of Pavlov in the study of abnormal children, and Ivanov-Smolensky has used chiefly the method of Bekhterev with school children.

Orbeli, the oldest living pupil of Pavlov's, worked abroad with Langley, and has devoted most of his energies to the investigation of the sympathetic nervous system. In the last decade he has included the study of language and subjective mental phenomena.

Bykov has probably made the greatest contributions after Pavlov by the method of the conditional reflexes, on the adaptations of the viscera (kidney, liver, thyroid, adrenal, hypophysis) to the individual environment. He has carried on independent investigations on these organs since 1925. Recently he received the Stalin prize.

Speransky, a neuropathologist, has produced some startling results and concepts, revolutionary to conventional medicine. These have been published in Russian and in English.[2] By some they have been hailed as brilliant contributions, by others as unfounded speculations.

Bolshevik Directives in Physiology

An extended account of the Pavlovian Conference held at the joint session of the Academy of Sciences of the USSR and the Academy of Medical Sciences of the USSR from June 26 to July 4, 1950, was published in a 734-page book, issued by the Press of the Academy of Sciences, Moscow 1950, under the title *Scientific Session Dedicated to the Problems of the Physiological Teachings of Pavlov*, of which there is an abridged account in English.[3] *Pravda* and *Izvestia* devoted considerable attention to the conference. An excellent review has been written by W. W. Gordon of Glasgow.[4]

Attending this conference were 1,400 delegates from Russia, including physiologists, biologists, physicians, and Marxian philosophers. (I have not heard of any American or English physiologist who was invited.) Prominent figures were the president of the Academy of Sciences, S. I. Vavilov (deceased 1950—the brother of the geneticist), and the vice-president of the Academy of Medical Sciences, I. P. Rasenov. Prof. K. M. Bykov spoke on "Problems and Perspectives of Pavlov's Concepts," and Ivanov-Smolensky, on "Concepts of Pavlov in the Patho-Physiology of the Higher Nervous System." The conference was reported in *Pravda*, June 29 to July 9, 1950 (speeches). On July 14 a directive of the Presidia of the two Academies appeared in *Pravda*. In a three-column account, suggestions were made for the "improvement" of medical work and education.

On July 28 *Pravda* carried comments by Yuri (George) Zhdanov (son of Andrei A. Zhdanov, late member of the Politbureau of the Communist Party) with suggestions for future work based upon the conference.[5]

The following synopsis of the criticisms is taken mainly from the July 14 issue of *Pravda*, and from Gordon's account.

Reprimands to Deviationists

Bykov and Ivanov-Smolensky spoke on the development of Pavlov's concepts in pathology and physiology. His objective method of studying the living organism and the physiology of the circulatory and digestive systems of the trophic innervation and of the higher nervous activity was emphasized. Credit was given to Lenin and Stalin for the establishment of scientific laboratories. The application of sleep therapy in psychiatry received attention. Botkin's ideas of pathological processes were discussed.

There followed a criticism of prominent Russian physiologists who had deviated from the above principles. First to be mentioned was Lena Stern and her school. (Lena Stern was an old-time Bolshevik, who had lived in Switzerland and had returned to the Soviet Union after the Revolution. She enjoyed the favor of the government for a long time, occupying the post of professor of physiology in Moscow.) She was accused of supporting reactionary, capitalistic science and of being "a false preacher of metaphysical concepts."

Prof. I. S. Beritov (Beritashvili in Georgian), a member of the Academy, and director of the Physiological Institute of Beritov in Tiflis, was said to have supported a reactionary science and an idealistic physiology, psychology, psychiatry, and neuropathology.

Beritov has had an active school of neurophysiology in Tiflis for a number of years. He has widely quoted and credited foreign workers (Bronk, Eccles, Gasser, etc.). His researches in electrophysiology led him to agree with Adrian concerning the spontaneity of the action potentials generated in the brain. His general work has shown considerable independence, although he has not neglected to elaborate the ideas of Pavlov. Rusinov attacked Beritov for considering any activity of the brain as "spontaneous." He furthermore alleged that if spontaneous electrical rhythm[6] existed in the brain, two Russians deserve the credit for its discovery—Danilevsky in 1875 and Sechenov in 1882. Biryukov described the "all or none" concept as metaphysical, in keeping with the late eminent Russian neurophysiologist, Ukhtomsky.

The criticism of Beritov did not appear to be political so much as na-

[2] A. D. Speransky, *A Basis for the Theory of Medicine*, translated and edited C. P. Dutt (New York: International Publishers, 1943), p. 48.

[3] *Scientific Sessions on the Teaching of Pavlov* (Moscow: Foreign Publishing House, 1951). Pp. 174.

[4] *Soviet Studies* (Glasgow, University of Glasgow, 1951–52), III, 34–59. Gordon's review is tempered by a spirit of tolerance, understanding, and balanced perspective of which even we in the West may be proud.

[5] After the Lysenko Conference in 1948, Zhdanov wrote a letter to Stalin acknowledging his errors in supporting Mendelian genetics. This is reprinted in Zirkle, *Death of a Science* (Philadelphia: University of Pennsylvania Press, 1949), p. 267.

[6] Adrian has reported recently that there is in the olfactory brain a definite "spontaneous" electrical rhythm.

tionalistic, based on Russian physiological concepts in the tradition of Sechenov and Pavlov; for Beritov apparently had been, as were Bekhterev and Lena Stern, an active supporter of the Soviet regime; in 1941 his *Transactions of the Beritov Physiological Institute,* which he edited, was dedicated by him "To the 20th Year Establishment of the Soviet Power in Georgia."

It is worth emphasizing that there is no evidence that Beritov had any political quarrel with the government; on the other hand his undoing apparently consisted in his supposed neglect of Russian physiology in favor of foreign physiology. This is another indication of the rise of nationalism in the Soviet Union and its increasing dominance at the expense of the old brand of Marxist internationalism.

Before this conference Orbeli directed three of the four research institutes formerly under Pavlov. He was accused of having been dictatorial in his attitude toward his collaborators and to have discriminated against other investigators. He was influenced by foreign and idealistic ideas and the philosophy of Wundt, Helmholtz, and Hering. His later work placed too much emphasis upon subjective methods, and supported psychophysical parallelism. He was accused of failing to develop cerebral pathological physiology in the Leningrad Institutes which he directed and failing to relate his science to the clinic. He did not show self-criticism or encourage free criticism and the conflict of opinions, and he became too authoritative. Directing many institutions, commissions, etc., he violated the spirit of Soviet science and impeded the freedom of scientific progress. Orbeli disagreed with Michurin genetics; he made errors in the "second signaling system" (language) of the human. Apparently Orbeli has been discharged from the directorship of these Institutes.

Orbeli, in his reply, acknowledged the need of self-criticism, but he defended himself by saying that his work conformed to Pavlovian principles.

Zhdanov struck the keynote of the Russian criticism when he said: "The point is that Academician Orbeli's scientific interests and work methods were formulated not so much under Pavlov's influence as under the influence of Western European physiologists with their metaphysical and idealist concepts."

Speransky was given credit for correctly emphasizing the role of the nervous system in pathology and attempting to overthrow the "decadent" ideas of Virchov. Speransky, it was claimed, had made several mistakes in not utilizing in the study of trophic nerves the facts previously discovered by Pavlov: "He confused the role of the nervous system in pathology in separating it from the role of the cerebral cortex in the activity of the total organism, substituting for this a confused verbosity about the nerve cells."

Anokhin, like Beritov, was criticized for undertaking a revision of the "basic materialistic concepts of Pavlov." In his reply Anokhin admitted certain errors—references to others who claimed discovery[7] of the conditional reflex, omitting to give Pavlov credit for his idea of the synthesizing function of the nervous system and for his study of the whole organism, and for the exaggeration of the importance of foreign neurophysiology. Anokhin was discharged from his position as director of the Institute of Physiology of the Academy of Medical Sciences in Moscow, being replaced by Professor Usiyevich.

P. S. Kupalov, one of the important pupils of Pavlov at the Institute of Experimental Medicine, who had worked in London with A. V. Hill in 1928, was attacked by Ivanov-Smolensky for his ideas on "shortened forms of the conditional reflex, inner stimulation, reflexes without a beginning and without an end."

In spite of the authoritative atmosphere enveloping those who made favored speeches at the conference, there is no assurance that in the future there will not be a reversal of official opinion toward any particular person. Thus Gilyarovsky—who spoke as a strong proponent of what the conference in 1950 endorsed, viz., the observance of Pavlovian principles through the use of sleep therapy and the condemning of leucotomy as contradictory to the idea of protective inhibition, was in 1951 severely reprimanded.

The work of Gilyarovsky and Guerevich in psychiatry has been described in detail in Joseph Wortis' *Soviet Psychiatry* (Baltimore: Williams and Wilkins, 1950). Gilyarovsky was a leading psychiatrist in Moscow. His teaching was somewhat similar to that of the late Adolf Meyer, with whom he had been in correspondence.

The conference resolved to furnish the Presidium the means whereby the teachings of Pavlov could be introduced into practical medicine, pedagogy, physical education, and animal husbandry; to charge the Presidium and the Ministry of Higher Education and Public Health to institute a plan of scientific work based on Pavlov's physiology; to give especial attention to the investigation of the higher nervous activity; to study the trophic nerves; to study the secondary signaling system (i.e., language symbols); the functional reciprocity of the cortex and the viscera, the development of experimental genetics of the higher nervous activity, the physiology of digestion, of the cardio-respiratory system; of pathological physiology and of ecology. The ministries of Higher Education and Public Health were further instructed to examine the progress of physiology in the universities as well as the courses in Pavlovian physiology, to introduce preparatory courses in basic physiology and pathology of the higher nervous activity into the universities, to give two-year courses in psychology and pathology in a number of institutes of physical culture; to make obligatory a physiological course for medical personnel. The board was instructed to bring up for annual criticism the problems in physiology; to strengthen the preparation of the medical personnel; to encourage scientific study of the higher nervous activity. Finally the conference recognized that "free scientific criticism and self-criticism" was for the good of the people.

Pravda stated that the conference revealed the attempt of physiologists

[7] Pavlov himself gives the credit to Thorndike; he says: "I must acknowledge that the honor of having made the first steps along this path belongs to E. L. Thorndike. By two or three years his experiments preceded ours . . . . his book remains a classic." Pavlov, *Lectures on Conditioned Reflexes,* I, 40.

His Master's Voice

"Comrade Stalin, the greatest scientist of our age, offers full support to all that is progressive and advanced in science. It is well known that the decisive role in the victory of the Michurinist biology over the pseudoscience of the weissmanists-morganists was played by the leading ideas of I. V. Stalin. Due to fatherly concern of I. V. Stalin, Pavlovian physiology was expanded and strengthened in our country. There is no field of knowledge that has not experienced the fertile influence of the genius of the great protagonist of science, I. V. Stalin."

★ ★ ★

"The development of science occurs through a struggle of progress against reaction, of materialism against idealism, of dialectics against metaphysics. We must know how to cut away all alien, unscientific influences that penetrate to us from across the border, and to overcome obsolete and conservative traditions that hamper the advancement of science.

"We must note the exceptional effect on the development of our Pavlovian physiology of the masterpiece of Stalin's genius, his study on 'Marxism and Problems of Linguistics.'

"Our Russian physiology, having been closely associated in its beginnings with the glorious movement of Russian democratic revolutionists of the 1860's, always has been a progessive science, materialist in outlook, and close to the people.

"In the Soviet period of his activity, I. P. Pavlov, due to the full support of party and of the government, has developed an investigation—unprecedented in its scope, rate of progress, and results—of the physiology of the large hemispheres of the brain. He has erected a grandiose structure of materialist theory of higher nervous activity and captured for our physiology the first place in the world.

"In the joint session of the Academies of Science and of Medicine in 1950, a broad discussion revealed that pupils and followers of Pavlov did not fulfil successfully their extremely responsible work, and owe amends to the country.

"In our research institutes physiology has strayed from the paths laid out by Pavlov; some of our leading physiologists—the Academicians L. A. Orbeli and I. S. Bentashvili, the member of the Academy of Medicine, P. K. Anokhin, and others—have tried to revise the basis of the greatest achievements of Pavlov's genius, substituting their own erroneous views.

"Revealing mercilessly the weaknesses in the work of Soviet physiologists . . . the session has outlined scientific and organizational steps needed to bring about fundamental improvement. . . . The Council of Ministers of the USSR has ordered the creation of two new institutes of Physiology—a mighty Pavlov Institute (to replace the Institute of Physiology of the Academy, and the Institutes of Evolutionary Physiology and Pathology of Higher Nervous Activity, and of Physiology of the Higher Nervous System, of the Academy of Medicine), and an Institute of Higher Nervous Activity in Moscow.

"The Presidium of the Academy of Sciences organized a Scientific Council to coordinate and direct throughout the country the development of Pavlov's teachings. Thus, through the special concern of party, government, and personally of Comrade Stalin, all the necessary conditions for radical improvement of work in this field have been created. More procrastination cannot be tolerated."

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"Discussion of the fundamental problems of biology in the USSR have had a great influence on science abroad.

"The Hungarian Academy of Sciences is reforming its work.

"Much is being done in the reorganization of biological science on the materialist basis by Polish scientists.

"Many scientists in Czechoslovakia and Bulgaria work in the same direction.

"In the capitalist world our discussions cause sharp cleavage of scientists into materialists and idealists, progressive investigators and reactionairies.

"Many leading scientists of capitalist countries have not followed the path of reactionairies in science.

"It is enough to point out that many of them have expressed the desire to become better acquainted with the accomplishments of Michurinist biology."

—A. N. Oparin[1]

[1] A. N. Oparin is a distinguished Russian biologist, chairman of the Biological Section of the Soviet Academy of Science. These quotations are from his address reprinted in the *Izvestia* of the Academy ("Biological Series"); No. 6 for 1951.

to create their own schools[8] in opposition to the teaching of Pavlov. The ministries of Public Health, Higher Education, the Department of Biological Sciences of the Academy of Science, etc., endorsed the position of the Congress. The Presidium of the Academy of Medical Sciences was criticized for not giving sufficient support to Pavlovian concepts in medicine; the physicians were also censured for this failure; these ideas were introduced too infrequently into psychological pedagogy and physical education. *Pravda* says: "The discussion showed that the scientists of our country possess the creative ability to apply science to all fields of physics, medicine, psychology, and agriculture."

Western scientists in general were attacked, although there were individual exceptions such as Darwin. Konorsky, a former pupil of Pavlov's, a Polish scientist who since the destruction of Warsaw has been established in Lodz, came in for a lambasting.

Among foreign scientists criticized were the late Sir Charles Sherrington, Freud, the American founders of psychosomatic medicine, and some of the older scientists (Hering, Wundt, and Helmholtz). Sherrington was denounced on the basis of his later subjective writings, expressed in his book, *Man on His Nature*, and for his imputed support of dualism. (Sherrington and Pavlov were friends and mutual admirers.)

A special attack was reserved for Freud and his followers. Psychoanalysis enjoyed a certain encouragement in the USSR until about 1930: since then there has been a steadily growing hostility in Russia toward Freud. A typical statement is: "The only true evaluation of psychoanalysis is to consider it as a fragment of bourgeois democracy. It is hopeless to try to accept one theory of psychoanalysis and to dispute the other. Those who attempted to inject Marxism into psychoanalysis ended up by being captives of psychoanalysis." (Wortis, *op. cit.*)

Psychosomatic medicine was considered dualistic as well as oblivious to the "social, environmental" origin of disease. Bykov produced evidence that "Western 'psychosomatic medi-

[8] The Russian word used is *shkolka*, meaning "little school," in a derogatory sense—one of those Russian diminutives with a shade of meaning that cannot be adequately translated into English.

cine' is a pale and freakish echo of the trend which, in our homeland, was long ago founded by leading clinical physicians in the form of the idea of nervism, i.e., the subordination of all processes in the organism to the nervous system in normal and disordered function." (Gordon, *op. cit.*, p. 52)

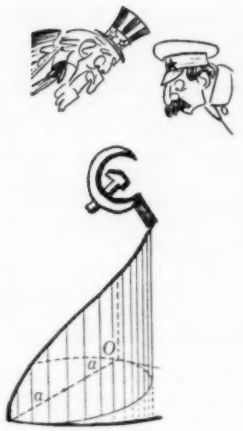
Mudrov (1776–1831), the physician mentioned by Tolstoy in *War and Peace*, son of a priest, had considered the interaction of mind and body, and Sechenov, Boktin, Pirogov, Ostroumov, Pavlov, Manassein, and Usov had also made contributions. In 1875 Manassein wrote *Etiological and Therapeutic Significance of Mental Influence* showing the relationship of the psyche to disease such as tuberculosis; and Usov in 1911 wrote: "a protracted neurosis (neurotic illness) can lead in a fatal manner to intestinal anatomic changes—there is a whole chain of functional intestinal diseases, the first links of which lie close to psychiatry." (*Gordon, op. cit.*, p. 53)

Psychosomatic medicine in the United States has been too often a superficial discussion of symptoms resulting from Freudian conflicts without any reference to the physiological basis as elaborated, e.g., by Pavlov and Cannon. The Russian criticism, however, has overlooked entirely the sound, basic ideas of Stanley Cobb, the work of Sargent, Elliot Slater, Horsley in England and Fabing and Alexander in the United States, and the objective, experimental contributions of Harold Wolff and his collaborators.

ANALYSIS OF BOLSHEVIK TRENDS IN PHYSIOLOGY

In attempting an interpretation, it is well for the reader to know something about the writer—the "Camera Eye." About myself I shall say the following. After a year with the American Relief Administration in 1922–23, I became sufficiently interested in the work of Pavlov to spend the next five years (after 18 months in England and on the Continent) until late 1929, working in his laboratory. My attitude toward Russia has been clearly stated in my articles and books.[9]

[9] W. H. Gantt, *Medical Review of Soviet Russia* (London, 1927); *Russian Medicine* (New York, 1937); "Results of the First Five-Year Plan on Health and Scientific Work in Soviet Russia," *British Medical Journal*, Vol. II, Nos. 4 and 18 (July, 1936); and Pavlov, ed. Gantt, *op. cit.*



Briefly, I have been primarily interested in Russian science, Russian medicine, and the historical development of the country under the influences of industrialization in its world setting, and, to a lesser extent, politics. I have suffered from the disadvantage of rarely agreeing with the popular appraisal of Russia in this country: during the thirties I did not approve of the unbalanced gullibility in America toward Russia, and since the end of the war I have felt that a more objective attitude would help us to that comprehension of Russia which would make possible an intelligent basis for a better rapprochement than that proceeding from an emotional hostility. I agree with H. J. Muller when he says: . . . "friendships founded on illusions may in the end be more dangerous than thorough understanding of one another." (Zirkle, *op. cit.*, p. 93)

On the other hand, with our background of centuries of evolution of rights for the individual, I do not feel that the Bolshevik system of government has anything to offer the Western democracies. With Wilson's general policy of leaving to each country the determination of its own form of government I concur. Since 1930 I have had only two visits to the USSR —in 1933 and 1935—and unfortunately in the past sixteen years my information has been derived only from occasional meetings with visiting Russian doctors and from what reports have appeared in some of the Russian publications available in this country. From this lack of direct contact with the USSR some errors will inevitably creep into this article notwithstanding my efforts to remain objective.

Before World War I, Central Europe, chiefly Germany and Austria, and to some extent Western Europe was the Mecca of world medicine; Russians as well as Americans traveled there for medical postgraduate studies—Pavlov and Welch, of Johns Hopkins, were students at the same time under Ludwig. Thus Russia and the rest of the world possessed common traditions in science and medicine. With the advent of the Bolshevik regime, however, it has become increasingly difficult for a Russian to travel and study abroad, owing to the double restrictions of the Soviets and, to a lesser extent, of their neighbors. It has been almost equally as difficult for a foreigner to study within the borders of the USSR.

Most of the older generation educated abroad and having common traditions with the West, such as Pavlov and Bekhterev, are no longer living. A very few, e.g., Orbeli, Krasnogorsky, and Kupalov who are now active in Russia received some of their education abroad. Such leading investigators as Bykov, Anokhin, and Speransky, have been wholly educated in the USSR.

Relation to Politics

World conditions and the social structure are everywhere rapidly changing. It will be interesting to compare the accelerated movement in the USSR with what we are doing here with less flurry and under less pressure.

Lenin struck the keynote of the new development when he said "without science, no communism." The Soviet government has been sincere and consistent in fostering the expansion of science from the very first—in spite of all the difficulties that confront the individual scientist in a totalitarian state. With those scientists wholly educated in a country having one overwhelmingly dominant and authoritative political philosophy, it is easy to see how they would conform to the political environment, although a relatively small number may actually be members of the Communist party. Under these circumstances, the Bolshevik scientists have gradually adopted their own credo for science, namely, that science is inevitably related to politics and that it serves the best interests of the people when it is "Marxian" science—whatever may be the contemporary governmental interpretation of that word:

We, the Soviet scientists, are convinced that the entire experience of history teaches that there does not exist and cannot exist in the world a science divorced from politics. The fundamental question is with what kind of politics science is connected, whose interests it serves—the interests of the people or the interests of the exploiters. Soviet science serves the interests of the common people. It is proud of its connection with the policy of the Soviet State, which has no other aims but the improvement of the welfare of the workers, and the strengthening of peace and the progress of democracy. (Zirkle, *op. cit.*, p. 311)

The point of view of the American scientists in regard to government and politics, on the other hand, is not well formulated—partly because it has not had to be; it ranges all the way from the Russian point of view at one extreme to the views of the theoretical, nonpolitical scientist (rapidly passing) who has believed that science is best developed without having to concern itself with the practical needs of our national life. As with most concepts in a democracy during peacetime, there is no common adherence to a clear-cut formulation. However, if we accept as representative of the best scientific opinion in America the words of two leading university presidents (Detlev Bronk, of the Johns Hopkins University, and James B. Conant, of Harvard) who have themselves been active in national affairs, we find an acceptance of an entente between science and government on certain terms. In regard to the relationship of science and culture Bronk in his book, *Science and Humanity*, says: "Our culture, shaped by science and dependent upon science for its preservation, is now changing the pattern and status of science in America."

He goes further to endorse an active role of science in government: "... it is desirable in a democracy that every citizen take an active part in the direction of government ... growing social conscience of scientists is desirable."

Bronk stoutly maintains, at the same time, that the individual scientist in a democracy not only should be, but can be, free to make his own decisions:

> In order that science may play that role well, the freedom of the scientists must be preserved against the regimentation of over-stuffed organizations here at home. . . . I should be surer of the social value of a mere score of scientists who are free to investigate and explain the facts of nature than of a thousand who are organized for the solution of a directed end.

Conant in his book, *On Understanding Science*, says: "There is no question that one of the necessary conditions for scientific investigation is an exact and impartial analysis of the facts." (p. 6)

Thus we see the American scientist cleaving, at least theoretically, to the principle of individual freedom irrespective of government or any outside authority.

Conant, however, in spite of his belief in this high principle for science, tacitly admits the difficulty of attainment when he says:

> We should examine and admire the conduct of the *relatively few* who in the midst of human affairs can courageously, honestly, and intelligently come to conclusions based on reasons without regard for their own or other people's loyalties and interests, and having come to these conclusions, can state them fairly, stick by them, and act accordingly. (*Op. cit.*, p. 113. *Italics mine.*)

In spite of this apparent gulf between the traditions and credos of Soviet and Western science, under the threat of national security and war in the West, and the centralization of governmental control, we find ourselves often drifting with acceleration along the road on which the Russians are militantly marching. Goldschmidt, in an article in the May 1949 *Bulletin of the Atomic Scientists* warns: "Dictatorships ... control not only the mind of their subjects but also what science is permitted to do and to think. Do not say this cannot happen here."

He points out that the needs of national defense require restrictions in some fields of science, that the trend everywhere is away from individualism toward collectivism. "Whether we like it or not this tendency is bound to increase." The magnitude of central support enhances the danger of political control. "Where there are federal or state allotments to science, the control will certainly not be in the hands of the scientists."

If we discard the armor of hostility to Bolshevik decisions and behavior, we can recognize in their problems some of those which we must face. A careful analysis of their errors—from our Western, democratic viewpoint—may help us to avoid the same pitfalls.

The Bolshevik scientist, immersed in the atmosphere of Marxism and the so-called "dictatorship of the proletariat" is often forced to relinquish the ideal of an individual science in subserving loyalty to his regime. In any environment it is difficult when the tension is great to proceed along a path without deviations induced by local pressures; it is only the exceptional man who can rise above these national policies, and, when he does, he is usually out of favor with those closest to him whether they be fascist or whether they be Marxist.

The Russian purges in the medical and biological sciences have not only been related to the supposed principles on which a Marxist society should be founded, but also on the newly developing Russian nationalism. The influence of nationalism seems now to predominate.

The purges in physiology were based partly upon what was judged to be sound investigation and partly upon whether the work had been influenced by "capitalistic, bourgeois, idealistic" foreign scientists. Nearly all those who were excoriated had either worked abroad, or had depended upon the concepts of Western scientists (such as Sherrington and Adrian who were accused of idealism) or had failed to give sufficient credit to former Russian scientists, regardless of their politics, such as Pavlov.

Much of the Bolshevik criticism, however, when stripped of its Western antipathy would be equivalent to the view being expressed by one or another group in this country and in Great Britain. Many on this side of the Iron Curtain would consider as well founded Bykov's criticism of psychosomatic medicine, psychoanalysis, etc., were it not voiced in a militant language.

The real tragedy of the Russian purges in science comes, in the opinion of the writer, not so much from their effect on science—here errors will in time correct themselves—as from the effect on the individual scientist; in a country where the policy is to sacrifice the individual for the supposed good of the group, this may be very serious, involving position and even life.

In spite of our grossest American blunders, inconsistencies, and injustices—the treatment of the American Indian, the prohibition on teaching Darwinian evolution in Tennessee, the restrictions of certain hotels "for Jews only" and "for Gentiles only" near New York City, the Jim-Crow regulations—we possess a tradition of habeas corpus and of personal freedom that prevents our being executed without due process of law, and that makes it possible for a person, though out-of-favor and deprived of work by one group, to find approval and the means of livelihood in another group. The tradition that has come to us through ages of struggle in the West on British soil and on American—outlined so clearly by Dos Passos in *The Ground We Stand On*—secures to us, during peacetime at least, the freedom to stay out of prison and to live. This is our great heritage.

The Russian scientist, however, does not have an exclusive monopoly on the use of vituperative criticism based upon nationalistic interests. There is not only a lack of understanding but often hostile language on both sides of the Atlantic. It is more difficult to see our own errors in this respect. However, if a Russian were to

read the bald statement that appeared in the *American Journal of Psychiatry* —that leucotomy was prohibited in Russia because it was anti-Pavlovian—he would have reason to complain of its inaccuracy; actually, the edict on prohibition states that: (1) the changes produced are irreversible; (2) its therapeutic value is not superior to more conservative methods; (3) it contradicts the teaching of Pavlov on protective inhibition. Such errors in our own scientific articles are less excusable than are those in the daily press.

Pavlov's Position in Russian Science

Since Pavlov has been recently established as an incontrovertible authority in Russia, it is imperative to understand what his real position was.

Why is Pavlov now a national hero? First, in any age, in any land, Pavlov would be either a martyr or a hero. The support of Lenin saved him from martyrdom.

Pavlov's position in the USSR was unique; he unflinchingly spoke his mind, daring the authorities, refusing personal favors, asserting the rights of science to be independent, exhorting his colleagues to resist political shackles; at the close of his life he belatedly though enthusiastically acknowledged the aid of the Soviet government to scientific work.[10] Though Pavlov had stated earlier that he would not sacrifice a frog's hind leg for the social experiment in Russia, during the last two years of his life he endorsed the attitude of the government toward science.

The changed position was undoubtedly stimulated by the increasing interest of the government in national affairs and by the gathering war clouds.

Pavlov's character and strength (defiance of authority, refusal of food for himself during famine, devotion to his research amid the roar of cannon, his patriotism in commanding a Russian surgeon to operate on him instead of the proffered German expert, scientific study of his own symptoms to within an hour of his death) fit him for the role of an epic hero in the future annals of Russia, like the great legendary figures of history.

Second, as well as a hero, Pavlov was a Russian patriot in the best sense of the word. Pavlov was a Russian patriot but *not* a nationalist. In science he was international; he revered truth above personal attachments; though he loved his native soil, he never let it interfere with his search for truth; his last hour and his last words expressed his zeal for science. Pavlov, in contrast to the present Bolshevik tendency to make science national, stood for free international communication. Though a patriot, he lamented the separation of scientists through war; at the Fifteenth International Physiological Congress in Moscow (1935), he exclaimed:

> We are all bound together by a feeling of comradeship—in many cases, indeed, by ties of personal friendship. We are working, assuredly, for the rational and final unity of mankind But if war were to break out many of us would become enemies precisely on our scientific plane, as has so often happened in the past. We would not want to meet as we do now. *Even our scientific appraisal of each other would change.*
>
> I can understand the grandeur of a war of liberation. Yet, it cannot be denied that war is essentially a bestial means of solving life's difficulties, a means unworthy of the human mind and its limitless resources. (Pavlov, *op. cit.*, p. 32)

Bronk endorses the desirability of internationalism in science when he says, "science has no national boundaries."

On both sides of the Iron Curtain the following statement of Pavlov has been quoted to admonish the other side—showing how scientists themselves are influenced in their interpretations by their locus in the universe:

> Be not overcome by vanity. On account of vanity you will be stubborn where it is necessary to agree; you will reject useful counsel and friendly help; you will abandon your sense of objectivity. (*Ibid.*, p. 189)

It would appear to the writer that Russian nationalism is now dominant over Marxism. Some of the Russian professors who were purged were themselves Communists, while those leading in the denunciations were not party members.

Historically, Russia finds herself on the threshold of Western industrialization and technology as well as on the stage of scientific attainment, with very little previous preparation, and, moreover, during a period of great world conflicts. Never having had a Renaissance nor Reformation comparable to that in the West, Russia is now an adolescent among already mature or aging civilizations.

Besides this historical position, Russia feels that she is surrounded by enemies and in a state of war with the outside world. These two factors—the historical position and the international tension—unite to produce an extreme nationalism.

Quo vadis? Russia has passed from feudal imperialism to revolution to Marxism-industrialization to Russian-nationalism.[11] In science we see a reflection of this development—how

[10] This phase of Pavlov's life is described in my biography of him in *Lectures on Conditioned Reflexes, op. cit.*

[11] I pointed out in 1927 in my "Medical Review of Soviet Russia" that the several factors to be considered in the predicting of Russia's future were not an adherence to Marxism but the historical position of Russia plus industrialization and other factors such as the emergence of the peasant and the establishlishment of a real Russian government rather than of the government by a feudal state headed by a European monarch.

(*Continued on page 206*)

VIII

The Diamat and Modern Science

PAUL S. EPSTEIN

This is the fourth group of articles in the symposium on science in Soviet Russia which the Bulletin *has printed this year. The February issues dealt with Soviet genetics and mathematics, the March issue with psychology and psychiatry and the position of the Soviet scientist today, and the June issue contained an article on Soviet statistics. Mr. Epstein, who here gives a general account of the effects of dialectical materialism on Soviet science and scientists, is a professor of physics at California Institute of Technology.*

IN STUDYING the position of intellectuals in sovietized countries the situation of scientists must be analyzed separately from that of writers and artists. Indeed, the conditions under which the scientists do their work are materially different from those which apply to other creative workers, and these differences derive from two sources; in the first place, science, in general—and modern physics, in particular—has developed its own philosophical point of view. Therefore, the scientist finds himself obliged to serve two harsh and exacting masters: the official credo of dialectic materialism, on the one hand, and the philosophy of science, on the other. Thus arises the question to what extent the demands of these two masters are compatible. In the second place, for the sovietized states, the usefulness of the results of scientific work is not of the same nature as the value of literary and artistic productions. This fact cannot fail to have some influence on the psychic atmospheres in which the two kinds of intellectuals live.

The term *diamat* is an abbreviation for *dialectic materialism*, current among Russian writers. We shall use this word to designate the particular form of dialectic materialism developed by Soviet philosophers, officially adopted by the Soviet government, and taught in the Soviet schools.[1]

The purpose of the following pages is to discuss the conditions which the diamat—so understood—creates for scientists and for scientific pursuits.

II. The Credo of Dialectical Materialism

It often has been said that Marxism is the religion of the Soviets; and by the same token the diamat represents the articles of faith of this religion. Permit me to recall here a very profound remark made by Wilhelm Wundt. Only those articles of faith are well chosen which are beyond human reason; if they cannot be understood, they are safe from getting into conflict with the advances of knowledge and from being disproved by science. Judged by this criterion, the diamat almost qualifies: it is true that it contains one embarrassingly positive point (to be discussed in section 6 below), which stems from the materialistic world view embodied in it. This is offset, however, by two other points, inherent in the dialectic method, which make it very flexible and almost take it out of the realm of logic:

1. The diamat holds that *internal contradictions are inherent in all things and phenomena of nature,* or in Lenin's words: "In its proper meaning, dialectics is the study of contradictions *within the very essence of things.*"

2. All reality is in constant flux and change, including the workings of the human mind. Knowledge is relative and truth unattainable: what is considered a good approximation to truth today may be found not so good tomorrow.

It would seem that a credo of such vagueness and adaptability should have made its confessors humble and prevented them from commitments on questions of scientific import. But this was by no means the case: beginning with Lenin, the theoreticians of the diamat made a number of pronouncements about questions of science which were quite unnecessary, in the sense that they were not inevitable consequences of the fundamental principles of dialectics. Nevertheless, these pronouncements became part and parcel of the official diamat policies and created a good deal of friction in the pursuit of science, resulting in disciplinary actions against individual scientists and in the condemnation of whole branches of scientific theory.

The action of the Soviet authorities against Mendelian genetics, which culminated in its complete annihilation, is too widely known to need more than mentioning. We shall restrict ourselves here to studying the conflicts of the diamat with the *science of physics.* This will give us a good picture of dialectics as it actually is, as it is interpreted in everyday practice by its official custodians.

III. Physics and the Diamat

The task of enumerating the planes of friction between the diamat and physics is greatly facilitated by several Russian papers published during the last three years. One of them is a report under the title "Lenin and Natural Science," read in January

This paper was presented at the conferences of the Congress for Cultural Freedom at Andlan, France, in September 1951. A French translation appeared in the magazine *Preuves* for December 1951.

[1] Cf., for instance, the textbook, *History of the Communist Party of the Soviet Union,* chap. iv (available in English translation).

1949 before the USSR Academy of Sciences by its corresponding member, A. A. Maximov. It is obvious that, in a solemn session of the Academy, an author would not be permitted to express his private views if their general trend were not approved by the authorities: it is the official party line that is announced through the mouth of Mr. Maximov. The contents of his report make it clear that the authorities had become aware of the difficulties inherent in some mistaken assertions made by the representatives of the diamat, since the whole paper may be termed *an orderly retreat from untenable positions.*

Maximov employs the usual technique of the Soviet debaters: imputing to their adversaries the very sins of which they are guilty themselves. He sets up straw men in the persons of some mythical bourgeois scientists whom he charges with the mistakes, in reality made by the expounders of the official Soviet line; but he has the grace to admit that a few Russian men of science fell into the trap of uncritically accepting the corrupt bourgeois views. Then he goes on to define the correct materialistic vantage point.

The subjects taken up are: (1) the theory of relativity; (2) the alleged unreality of mathematical physics; (3) the apparent paradoxes of the quantum theory. Although Maximov seems to know a good deal of science, his equipment is inadequate for a full understanding of theoretical physics. Hence, the job he did was superficial and incomplete, leaving the matter in a state where further strategic retreats of Soviet philosophy are unavoidable. As far as relativity is concerned, a further step was indeed taken in a paper by G. I. Naan (1951) which will be considered in the next section.

It goes without saying that in the further discussion we shall present the older Soviet point of view, not as Maximov sees it, but as it stands revealed in the writings of Lenin and in other official sources.

IV. The Theory of Relativity

In the field of the *theory of relativity* the Soviet philosophers created for themselves two difficulties, both of an entirely verbal nature. The first is inherent in the vagueness of the words "matter" and "material." These terms are remnants of eighteenth-century ideas and do not form part of the formulation of any law of modern science. If used at all in scientific writings, they are catch-alls for ill-defined and varying qualities of nature.

Lenin was not satisfied with the vague definitions given by Marx and Engels but had recourse to the idea of identifying matter with mass; "Matter is that which has mass." In consequence, the observation of physicists, that the mass of an electron decreases as it slows down, troubled Lenin, since it seemed to involve the disappearance of matter, a conception which he was not prepared to admit. The argument was later taken up by Lunacharski from the point of view of Einstein's law of equivalence of mass and energy. He charged that the bourgeois physicists were trying to remove from science the concepts of mass and matter and to replace them by energy. Hence, the theory of relativity is idealistic and must be condemned as contrary to materialism. Maximov correctly points out that there is actually conservation of mass, because the mass lost by the electron turns up as mass of the radiation emitted in the process of slowing down, so that the Soviet idea of materialism is not threatened by this phenomenon.

The second difficulty also derives from a verbal misunderstanding; it has its root in the rather unfortunate name chosen by Einstein, namely, *theory of relativity.* This leads to all sorts of misapprehensions since it seems to imply that there is nothing absolute. The Soviet theoreticians lay great stress on the absolute (if unattainable) truth and on the immutable laws of dialectics. Hence, the denial of all absolute values, which was imputed to relativity, was a stumbling block for the Marxist philosophers and a serious contributing cause of its condemnation. In reality, the theory of relativity makes no such claims, and its importance does not lie in pointing out the variable aspects of most phenomena in dependence on the frame of reference: indeed, this variability was obvious long before Einstein. The great achievement of the theory lay in the diametrically opposite direction, in the disclosure of the immutable invariants of nature lying behind its relative aspects.

As early as 1908 this was pointed out by Minkowski, who proposed to discard the name "theory of relativity" and to replace it by the term "theory of the absolute space-time." Maximov's background is insufficient to understand that the difficulty is self-created and imaginary; he believes in its existence and proposes several makeshifts to get around it. Quite unnecessarily, he suggests that the mathematical formulas of the theory of relativity must be accepted but no philosophical conclusions should be drawn from them.

The most recent Soviet point of view is contained in the paper by G. I. Naan[2] already mentioned. With the most impudent perversion of truth Naan makes a complete about-face and falsely claims that the bourgeois scientists of the West regard the theory of relativity as conflicting with materialism and, "acting with their usual rascally tricks," advance it as an argument against Marxism, while in reality there is no conflict. Section 4 of the paper is entitled "On the Errors of A. A. Maximov and of Others" and takes that author to task for not going far enough and not accepting the whole of relativity in its mathematical and philosophical aspects.

Thus a campaign of thirty years' duration against the theory of relativity, which had caused to numerous scientists much inconvenience and to a few serious mental and physical suffering, turned out to have been much ado about nothing.

V. The "Idealistic" Uses of Mathematics

The problem of the so-called "idealistic uses of mathematics" by physicists also goes back to Lenin. As in the case of the notion of matter, the root of the difficulty lies in the persistence of some ancient ideas, long discarded by modern science. As seen by the early physicists, the aim of theoretical analysis consisted in the "explanation" of all natural phenomena in terms of movements and collisions of particles. However, this point of view broke down with the discovery of the properties of the electromagnetic field in the nineteenth century. Since the attempts to press them into the old mold were unsuccessful, it was proposed by Heinrich Hertz to take the equations given by Maxwell as the ultimate description of the electromagnetic phenomena,

[2] "On the Question of the Principle of Relativity in Physics," *Problems of Philosophy,* No. 2 (1951), p. 57.

instead of trying to reduce them to mechanisms.

This approach (later extended to other fields of modern exact science) was troubling to Lenin. Inasmuch as these equations were set up by man, he argued, the electromagnetic field itself becomes a creation of the human mind and not a reality of nature. The theory is, therefore, idealistic and contrary to the materialistic world view. This is the original example of the so-called *idealistic uses of mathematics,* since then they were discovered by the priests of the diamat in the writings of many scientists.

With respect to this problem, Maximov's mediating position is correct and adequate. As he points out, the equations in question were derived from numerous observations; therefore, they represent the results of objective experiments fully as much as do the laws of mechanics. Undoubtedly, Maximov's views had the endorsement, at least, of a part of the diamat authorities, but this does not mean that the subject of unrealistic theories was disposed of once for all. It means only that the abundant use of high-powered mathematics may be justifiable *in some instances* and that every case must be decided on its own merits. Thus the Soviet scientists are always at the mercy of the interpreters of the diamat.

More than a year after the reading of Maximov's report, serious charges were preferred against some of the leading organic chemists of Russia (1950). The accusations came from a committee especially set up by the USSR Academy of Sciences for the purpose of purging Soviet chemistry of all reactionary ideas borrowed from bourgeois science. Conspicuous among the charges was the idealistic use of mathematics.

VI. The Quantum Theory

The areas of collision treated in the two preceding sections were due either to misconceptions or to arbitrary interpretations of dialectics. The only genuine conflict between science and Marxism exists in the field of the quantum theory. It is the more important because it is concerned with the only unequivocal assertion of Lenin's materialism incorporated into the official diamat.

In its ontological aspect the philosophy of Lenin is a primitive dualism: Complete reality is attributed to the *outer* (material) *world,* which is quite independent of its observers and would exist in the same form in their absence. In this respect, the saying of Engels is accepted: "The materialist world outlook is simply the conception of nature as it is, without any reservations." The second world, the *inner world* of the observer consisting of his sensations and perceptions, is produced by the stimuli of the outer world and constitutes its "reflection," that is, an approximate reproduction, which is at best close, but never ideally exact.

It should be pointed out that taking for granted that the things of the outer world always exist in the same form in which they are observed is a metaphysical assumption, in the sense that Lenin had no objective way of knowing whether it was true and, certainly, no scientific foundation for it. Since Lenin's time modern science —through its advances in the field of the quantum theory—has developed a world picture in some respects different from his, which may be termed a *modified dualism.* Of course, the physicist has to start from what is directly accessible to him, namely, from the *world of the observer.* He thinks of it not in terms of sensations and perceptions but as the physical world of the totality of his observations, secured by his measuring and recording instruments. The mathematical formalism developed for the best description of the accumulated data, however, contains the recognition of an *outer world* beyond the observer.

One part of this formalism consists in the mathematical means of describing the inferred outer world as long as it is unobserved; another part —of a different mathematical structure—refers to the erratic disturbances which arise in the world of the observer through his unavoidable interference with nature, in the pursuit of his business of securing measurements. This interference involves the well-known interruptions of causality characteristic of the quantum theory, the so-called paradoxes of the principle of indeterminacy, which take place at the points of interaction between the outer world and the instrumental paraphernalia of the observer. We call this dualism *modified* because it is unlike the primitive realism of the diamat: the world of the observer is not a replica, or "reflection," of the unobserved outer world but is different from it because of the modifications introduced by the process of measurement. Indeed, the descriptions of the unobserved outer world is *causal* and that of the world of the observer *acausal.*

This is only one of the possible ways of bringing out the conflict between the point of view of modern science and primitive dualism; there are many other ways of stating it. It is true that the contradictions manifest themselves only in the narrow area of atomic and subatomic phenomena; but they are of a profound philosophical importance and have acquired practical significance since the utilization of atomic energy became a reality.

The position taken by the Soviet authorities in this conflict is reminiscent of the controversy between Galileo and the Vatican. The Roman Curia was ready to grant him the *imprimatur* on condition that he

treated the revolutions of the earth as an astronomical theory and not as a fact. Similarly, the Soviet state permits the use of the quantum theory—including the principle of indeterminacy—as an instrument of scientific research in technical publications but militates against its philosophical consequences.

It must be pointed out that the fear of the diamat philosophers to recognize the interaction of observer and observed is based on a misconception. What they are afraid of is the idea that the phenomena of nature are, in part, created or influenced by the human mind. This would be, in fact, *idealism;* and according to Lenin "philosophical idealism is a road to clerical obscurantism" and, further, "religion is the opiate of the people." But the world picture of the quantum theory is not, in any sense, idealistic; both the outer world and the world of the observer are physical worlds, and the reactions on the outer world which the theory postulates are caused by the *instruments* of the observer and not by his way of thinking.

It is easy to understand that the Russian authorities are reluctant to change the slightest letter of their creed, but it should not be hard to find a formula preserving its spirit and making the necessary concessions to science. In the long run this adjustment will have to be made, and it will be far more painful than the small strategic retreats announced by Maximov and Naan.

In the meantime, the Russian cen-

sors do not yet understand the situation; they see the ghost of idealism in quite innocent passages.

VII. The Position of Soviet Scientists before 1936

In returning to the question of the situation of scientists in the Soviet countries, it is best to use the historical approach. Right after the communistic state was established and the diamat was proclaimed as its official credo, science became a very attractive field for able and ambitious young Russians, since it was the only type of intellectual activity unaffected by politics. Writers and artists were expected to put their talents at the service of the state and to engage in direct or indirect propaganda for the communistic way of life. On the contrary, science was indispensable for the Soviets' industrial future on its own merits, and the scientists played a role useful to the state in their legitimate pursuits as researchers and teachers.

Compared with other Soviet citizens, their lot was indeed a happy one: they enjoyed a high social and economic standing and—apart from a few exceptional cases—they were unhampered by political interference in their work. This accounts for the growth of the achievement and prestige of Russian science in the period between 1920 and 1936, which may be considered the Golden Age of the Soviet scientists. As private citizens they could accept the diamat or treat it with skepticism, but, on the whole, they were free of conscientious scruples in their profession because the scientific philosophy, described in the preceding section, had not yet crystallized.

Even in this period the sky was not altogether cloudless. The authorities were pressing for practical results and were, at first, reluctant to support pure science; at length they were persuaded that applications are contingent upon thorough basic research. A few philosophically inclined members of the Soviet hierarchy made nuisances of themselves by stirring up in their writings the spurious issue of idealism in physics, discussed in sections 4 and 5.

I am aware of several disciplinary actions against individual scientists on that score which should not be passed over lightly: the totalitarian state is so powerful and implacable that even those accused, who are ultimately exonerated, go through a period of acute mental anguish at the possible prospect of losing career and livelihood and ending up in a concentration camp. Yet, for two reasons, it seems unnecessary to enumerate these cases.

In the first place, they were not part of a concerted campaign of regimentation but the sporadic actions of individual high bureaucrats—either sincere but unwise zealots or jealous troublemakers.

In the second place, the grounds for the accusations lay usually in activities outside the laboratory, such as philosophically colored popular writings and oral utterances.

For the larger part of the period in question this was true even for the field of Mendelian genetics whose results ran afoul of a particularly deep-seated complex of proletarian inferiority feelings. Although Mendelism had been early attacked by a few Soviet writers, the work of its exponents proceeded without interference until 1932. Sporadic actions against individual geneticists started only after that date, and a large-scale persecution, including the dissolutions of the Medico-Genetical Institute, followed in 1936.

I skip over the periods of the great purge and of the world war, as an abnormal and uncharacteristic time, and I turn directly to the present postwar era. In describing the situation of the scientific intellectuals I have in mind the USSR only. If the conditions in the satellite countries are different, this is probably due to a time lag: before long they will be brought in conformity with those in Russia.

The social and economic standing of scientists remains high and is not now appreciably different from that of the preceding period; but the mental climate in which the scientists work underwent a considerable change due to their coming to grips with the diamat. While their former relations with dialectics may be described as a distant bowing acquaintance, two circumstances are now intruding it upon the intimacy of their professional lives. In the first place, science is now in possession of its own epistemology, and the scientists are no longer philosophically innocent and neutral.

The consequences of the quantum phenomena were fully developed and appreciated during the thirties. Now even the rank and file understands them to be much subtler than is envisaged in Lenin's naïve dualism. In the second place, the government embarked on an ill-advised policy of rigidly enforcing the Marxist line in science as well as in all other cultural activities. By a resolution of the Central Committee of the Communist party (1949) the scientists themselves were mobilized for the police work: every branch of science was directed to organize a committee "for the struggle against reactionary ideas of bourgeois origin."

A penetrating analysis of the relations of writers and artists to the diamat was given by Czeslaw Milosz;[3] he divides them into two groups: those who serve Marxism without believing in it, succumbing to the inescapable necessities of their existence, and those who become sincere converts, in order to achieve true self-expression by patching up the rift between their writings and their convictions.

The second way—the way of being true to their own selves by adjusting their beliefs to the party line—is closed to the scientists. They cannot accept the diamat epistemology for the reasons outlined in section 6, nor do they have a high opinion of dialectics as a research method. Hegel, Engels, and Lenin claimed that it is only necessary to study "the contradictions within the very essence of things," in order to arrive at the truth about them.

The scientist will admit that in the rare cases when two independent scientific results seem to stand in sharp contradiction, the resolution of this contradiction always involves an important advance of science. However, the most thorough knowledge of the diamat does not equip the researcher for effecting the resolution. Finding it is always a difficult step, depending on the emergence of new scientific points of view, which often take a very long time to crystallize. Indeed, one of the favorite examples, adduced by Soviet writers as illustrating the applications of dialectics to science, sounds almost like the derision of its methodological value. It refers to the inconsistencies in the axiomatic foundations of geometry which led to the discovery of its non-Euclidean branch. These difficulties were felt in antiquity but they were not resolved until more than two thousand years later, through

[3] Czeslaw Milosz, *Situation of the Intellectual in the Popular Democracies* (1951).

the new points of view supplied by Bolyai and Lobatchewsky.

The only adjustment left open to the scientists is the way of duplicity: giving lip service to the diamat and keeping silent about their reservations. Whatever the subject, all their writings, meant for a wider audience, follow the same formula: quotations from Stalin and Lenin, in the introduction and conclusion, and a sneering denunciation of the corrupt Western scientific practices, at a convenient place in the middle.

We have seen (in section 6) that the field of genuine conflict between science and dialectics is fairly narrow, being restricted to the quantum theory, i.e., to molecular, atomic, and subatomic phenomena; therefore, one might have thought that most of the specialized subjects lie outside it. But arbitrary and spurious interpretations of both the diamat and science widen the danger zone to such an extent that it is almost universal. Especially, since policing committees were set up within the scientific organizations themselves, the most technical passages of the most advanced investigations are not immune from the accusation of containing "non-Marxian ideology."

The critical activities of the various committees, created by order of the Communist party, resulted so far in a report, rendered by the committee on organic chemistry, and an editorial in the journal *Kultura i Zhisn*, dealing with geography. These criticisms brand as "ideologically faulty and reactionary" certain trends and theoretical conceptions of current research and list by name the specialists guilty of their uses—among them, some men of the first rank. In particular, the accusations against the organic chemists are those of "idealistic uses of theory" and of "subverting the clear materialistic concepts, due to Russian scientists, by the faulty ideas of decaying capitalistic science."

In the public annual session of the USSR Academy of Sciences last year the accused scientists were put on the carpet for the purpose of "criticism and self-criticism." As in a revival meeting, they were expected publicly to confess their sins, smiting their breasts and repeating: *Mea culpa, mea culpa.* According to the report in *Pravda* not all of them submitted to the ordeal with the required docility, so that their cases are not yet closed.

How was the audience affected by this spectacle—by the sight of eminent men being forced to humiliate themselves, after a lifetime of devoted and successful service to science? Were the onlooking scientists captivated in favor of the diamat? Could they see in its champions anything but foolish doctrinaires or malicious intriguers? Indeed, the accusations were so arbitrary and unreasonable that only men completely unfamiliar with the mathematical methods of science could have advanced them in good faith.[4] It was a disturbing warning to all listeners: from now on they must watch carefully every word and expression they write, or they may find themselves in the same predicament. Inevitably, the worry and apprehension must make the process of publication distasteful to them and must react back on their will to work. Their enthusiasm for research will be dampened if bringing out its results is connected with so much trouble.

Quota Assignments for Soviet Scientists

It is true that most Russian scientists would find it difficult to reduce the quantity of their output. To a large extent, modern science has become a cooperative undertaking of many men, so that the planning of a research program of a national scale is very helpful in coordinating the work and eliminating duplication and waste of effort. For a long time, the national planning has been in the hands of the council of the USSR Academy of Sciences, which assigned definite research responsibilities to individual laboratories and scientists. It seems, however, that the government is now treating these assignments on the same footing as the quota assignments to industrial plants.

In last year's meeting of the Academy many laboratory directors were publicly reprimanded for not fulfilling their quotas. Apparently, the standing of a scientist is judged by the number of papers he publishes. The danger of this policy lies in the obvious fact that the authorities can prescribe the number and length of the publications but cannot control their quality. If the quantity of output must be maintained, the general flagging of scientific enthusiasm will necessarily lead to a lowering of research standards. It seems that this process is already well underway: during the last year several of my friends remarked to me on the deteriorating quality of Russian papers in the field of physics.

[4] The accusations are repeated and extended in a recent paper by M. I. Batuiev, *Voprosy Filosofii* (1951), p. 78.

Even greater hazards await those scientists who tackle the difficult but necessary task of making the results of modern science accessible to the wider public. They are not allowed to use the expedient of the researcher—to present the underlying theories as mathematical devices and to refrain from discussing their possible bearing on philosophy. Instead, they are willy-nilly dragged into philosophical controversy.

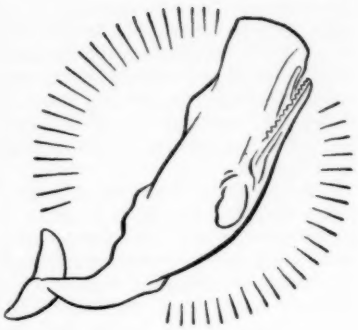
A case in point is the recent book on *The Basic Conceptions of Modern Physics* by the academician A. F. Ioffe, the venerable builder of Russian physical research, the teacher of most men now prominent in his field. The review of this book in the official *Voprosy Filosofii* (1951, II, 203) was written by a certain Omelianovsky who sermonizes the illustrious author like a schoolboy, reproaching him for keeping aloof from philosophy: "A Marxist book . . . should rest on the foundation of the most recent achievements of historic materialism. . . . The reader will look in vain for . . . an exposure of the idealistic falsifications of modern theory in the conceptions of bourgeois scientists, or for a criticism of idealistic rudiments in the scientific work of Soviet physicists." As a comic relief comes his charge that Ioffe failed to explain the Soviet point of view on the theory of relativity, meaning the point of view which was announced only that year (see section 4) and which stood under condemnation at the time the book was written. In short, the review does everything possible to discourage the popularization of science.

What general picture of the situation of Russian scientists emerges from all these considerations? It is safe to say that the scientists form a group critical of the official Marxist philosophy and, in turn, distrusted by the authorities, therefore, a group vulnerable to Western propaganda. The behavior of the Soviet rulers toward them is strangely contradictory: on one hand, large sums of money are spent on research and a high social standing is accorded to the researchers; on the other, their productivity is crippled by arbitrary interference and by petty annoyances.

Undoubtedly, this curious manner of acting finds its explanation in an ambivalent mental attitude. The Russian authorities need the scientists but, at the same time, they are afraid of men who, because of their training, are able to see through the hollowness of the Stalinist claims.

MOBY DICK AND THE ATOM

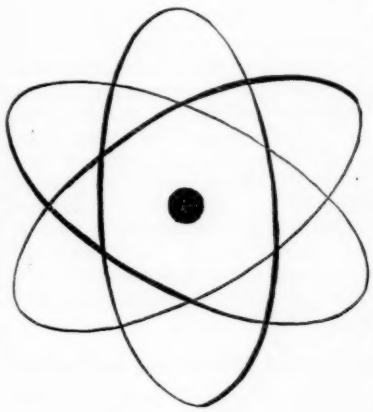
GILBERT WILSON



The author and illustrator of this article is a muralist. He has painted murals notably in Indiana and at Antioch college in Ohio. At present he is engaged in a series of color drawings to accompany his dramatization of Moby Dick, *which will be used in an art film and, the artist hopes, eventually in a music drama. Mr. Wilson is the author of* Letters of William Allen White and a Young Man.

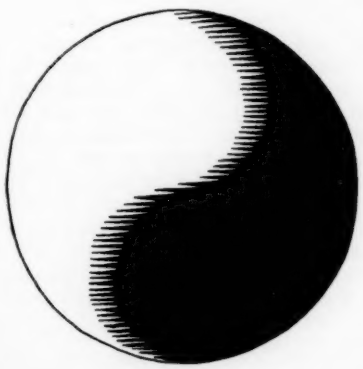
"Oh, trebly hooped and welded hip of power!"

AS AN artist I have asked for space here to express a few thoughts. These thoughts will deal in part at least with the subject of the atom. If at times I am unscientific in what I try to say, please bear with it. And if my ideas should seem only poetic or my choice of words something less than matter-of-fact, you must excuse that also. But the scientist and the artist after all are both striving essentially toward the same goal—something called truth. I only wish to pose certain questions—questions about the atom, its nature and significance in relation to human life—and see if there can possibly be any points of similarity in our efforts to approach ultimate answers.



Personally, I have always envied the scientist. He holds a high place in society. He is needed; he is respected; he belongs. The same cannot be said for the artist. Maybe at one time—certainly in other ages—the artist belonged. Look how art is all that remains to tell of past civilizations—Egypt, Athens—and we can see how vital a part art played in those times. But the creative function of the modern artist is no longer linked up with any great traditional meanings in the social scheme. Religious beliefs no longer supply inspiration. The church is no longer a patron. The artist today is lost. He is the great orphan. Call him Ishmael.

Some five or more years ago, having no walls to paint on, I went to work on *Moby Dick*. The great drama of the tale fascinated me. With its powerful fantasy and the larger-than-life character of Ahab in pursuit of a great White Whale, the story possessed all the stirring elements of grand opera or music drama.



The White Whale as symbol bears disturbing resemblance in our time to the atomic bomb. It is not exactly the bomb either, but rather, let us say, the power within the atom. Because I think we have to regard the Whale as the great Dragon (Monster-Serpent), which appears in all mythology, and which as we know symbolized *both* Good and Evil. So the mythic White Whale was simply a tremendous embodiment of force. Melville had Ahab describe the Whale with an image remarkably similar to the conventional symbol of the atom used by artists. "Oh, trebly hooped and welded hip of power!"

To make the analogy clearer, we must remember that men hunted whales principally for the oil as a source of fuel to light lamps. "The year *Moby Dick* was published the American "fishery" was at its peak, supplying the world with most of its illuminating oil, spermaceti candles, and whalebone. Our whaling fleet was more than three times the size of the entire European fleet. In 1846 the American fishery employed 40,000 men. In 1854 the value of its products was nearly $11,000,000."[1]

As an industry, whaling in America was comparable to the oil industry in our current world; and which industry, by the way, is itself becoming obsolete, with the modern scientist investigating the atom to get at a new source of energy for man.

Who knows, if we approach the tremendous elemental force in the atom with hostile and destructive intentions as Ahab approached the White Whale, perhaps we too are doomed, just as Ahab and all his microcosmic crew on the Pequod were doomed and destroyed. It could hardly be considered

[1] Preface of *Moby Dick*, edited by Willard Thorp (Oxford University Press).

as a warning, but it is interesting that the sensitive and prescient mind of Herman Melville should choose to describe the approach of the storm in his story: "It will sometimes burst from out that cloudless sky, like an exploding bomb upon a dazed and sleepy town."

As is true of all great works, there is much in *Moby Dick* which touches trenchantly on the critical problems of our present day. For instance, take Ahab's "fatal pride" and domination as a white man, "lord over the Pequod," commanding blood from three dark-skinned savages with which to baptize the harpoon. Or, quoting the late F. O. Matthiessen of Harvard: "Melville created in Ahab's tragedy a fearful symbol of the self-enclosed individualism that, carried to its furthest extreme, brings disaster both upon itself and upon the group of which it is a part."

Considering the pre-eminence of American whaling in the 1850's, with the intrepid captains of the ships personifying in the best sense the dauntless courage and aggressive vigor of the rugged individualist, perhaps it is not out of order to imply that *Moby Dick* carries an admonishment of an unrestrained free enterprise. But then again, with its all-inclusiveness, a chapter in the book has something to say about "irresistable dictatorship" and "plebian herds that crouch abased before the tremendous centralization." However, we might indeed pause to wonder why Melville let his ill-fated Ahab cry out in the midst of the catastrophe: "The ship! The hearse! . . . Its wood could only be American!"

Moby Dick at Bikini

Only a century after Herman Melville wrote his great book, our own American atomic engineers unwittingly selected almost the very spot in the broad Pacific some few thousand miles southeast off the coast of Japan where the fictional Pequod was rammed and sunk by the White Whale. The ubiquitous mythic monster breaches again today at Bikini. "Rising with his utmost velocity from the furthest depths, the Sperm Whale thus booms his entire bulk into the pure element of air, and piling up a mountain of dazzling foam, shows his place to the distance of seven miles and more. In those moments, the torn, enraged waves he shakes off, seem his mane; in some cases, this breaching is his act of defiance."

I do not know how true it is that atomic radiation can result in sterility, but if there is any basis for it, then Moby Dick and the atom are still further uniquely analogous. We will recall that Moby Dick one time had caused Ahab the loss of a leg. But the real clue to the captain's vindictive feeling toward the White Whale goes deeper. Let Melville tell it:

"And indeed, it seemed small matter for wonder, that for all his pervading, mad recklessness, Ahab did at times give careful heed to the condition of that dead bone upon which he partly stood. For it had not been very long prior to the Pequod's sailing from Nantucket, that he had been found one night lying prone upon the ground and insensible; by some unknown, and seemingly inexplicable unimaginable casualty, his ivory limb having been so violently displaced, that it had stakewise smitten, and all but pierced his groin; nor was it without extreme difficulty that the agonizing wound was entirely cured. . . . Unwittingly here a secret has been divulged. . . ."[2] Could Ahab's unmanning be compared to sterility?

Good and Evil—Love and Hate

The mythological Dragon-Serpent as symbol of Good and Evil is cogent with meaning. (Even Christ in the Bible three times identified himself with the serpent.) Myths and prophecies have an uncanny way of touching into truth. They would seem to reflect a kind of grave racial wisdom. I would venture therefore further with the analogy of the Whale and the atom.

In as much as the atom is composed of positive and negative charges, I am put to wonder if they might be compared abstractly to Good and Evil. If there is a scientific principle in relation to matter which implies a necessary balance of cohesive and expansive forces, would it be reasonable at all to suggest the analogy of Love and Hate—defining Love as the force which unites and holds things together, and so, in turn, defining the divisive force of Hate as the balancing factor?

[2] Chapter CVI, *Moby Dick*.

MAP LOCATES TRAGEDY OF MOBY-DICK IN RELATION TO ATOMIC WEAPONS TEST

Such a proposition, if feasible, could seem to account for that huge, terrible and dark side of life which is so difficult to countenance and explain. By the same token the problem of understanding life then would be simplified. The problem would not be the elimination of Hate (Evil), but rather the acceptance of it. And with such acceptance, instead of going mad in the combat of Evil, as did Ahab, we might survive like Ishmael. Certainly, if by some reason we can come to see that what is called Hate (or Evil) is only a balancing factor in a huge scientific equation, then we might get on better with the regeneration of Love.

The scientist knows that a hell of awful power can be released destructively when there is set up what he calls a "chain reaction" among atoms. If such a "chain reaction" goes uncontrolled, we might suppose it could mean some kind of far-reaching if not total disaster. Maybe the present state of world affairs can be compared to an uncontrolled "chain reaction," where the little positive nuclei of Love are being bombarded and destroyed, releasing their surrounding negative electrons of hostility, which have nothing then to hold them in their proper orbits. So each of the world's wars becomes in a sense an ever more violently devastating "atomic blast." If such analogy holds, then those "chain reactions" in the human being had better be brought under control.

I trust it would not be too poetic to maintain that Love can be self-regenerative and serve to stabilize a world going virtually to pieces. I can believe it just as readily as I can believe the new theory advanced by astronomers who speak of a "balanced universe," where matter is being constantly reformed into new stars to fill the voids left by expanding galaxies. (For that matter, what is to prevent us from believing that an ever more powerful bomb might be the means of converting this planet back into a gaseous state!)

Moby Dick's arresting prophecy of doom, and at the same time its reaffirmation of man's transcendent spirit in his struggle against natural force, might serve as a revealing reflection of the world predicament today. Possibly no tragedy in world literature quite succeeds as powerfully or as clearly in pointing up the mortal errors of domination and destruction.

BOOKS

History Without Statesmen

Homo Sapiens. By HANS THIRRING. Vienna: Ullstein Verlag, 1947. 2 vols. Pp. 312 and 370.

IMAGINE that by dint of miracle the invention of Faraday and all its consequences were suddenly undone. Darkness would reign. Motion would stop. Communication would be interrupted. The workers would abandon idle factories; tractors and plough-shares would refuse their services; and the cows in the barns would ache under the clumsy hands of husbandmen accustomed to electric milking machines. Our economic system would be disrupted, and the face of the earth would be changed.

Imagine, on the other hand, that the good God decreed *ex post facto* the battles of Caesar, of Napoleon, or of the World Wars, undone. They simply would never have taken place. What difference would it make to the hustle and bustle, to the striving and failing, to the glamor and the fleetness of our civilization?

It is not the generals and statesmen, then, who make history and who leave enduring marks on the fabric of time. It is the men of culture and science who do what counts. Our infant civilization may not yet be aware of this reality, but historians of, say, the year 30,000 A.D. will have corrected our faulty perspective. The entry on Napoleon, in a textbook of that time will be as severe as it will be succinct, and a history book of the year 300,000 A.D. will omit his name altogether in consideration of his total irrelevance. The great statesmen and generals, those killers and destroyers for the sake of meaningless conquest or of a momentary fad, will be looked upon, if at all, with the curiosity we have today for the antics of some clanish chieftain of preglacial cavemen.

Directness and Detachment

While reserving judgment as to the validity of this vision, this reviewer is charmed by its directness and detachment. Directness and detachment are, perhaps, the two epithets most descriptive of the two volumes of Hans Thirring's *Homo Sapiens*—qualities which make the reading both easy and impressive.

There is directness both in his observation of the facts and in his approach to the reader. There is palpable human feeling, whether the author deals with the abstractions of typology or with character analysis, and it is always illustrated by concrete experience, as, in the description of the periodically recurrent marvelous metamorphoses of his own manic-depressive mother, the absurdities of the passport formalities, the economic barriers, the extravagant means lavished on the defense of the "inner frontiers" dividing irrationally the two dozen midget states on that small but fateful continent of Europe. Directness of experience breathes from the pages describing the ravages and misery of war, as well as from those testifying to the elation and "transfiguration" of which the human soul is capable in the face of art or nature. The author emerges from these two volumes not only as a great scientist and a man of broad culture and refined taste, but as a human being who can live and love.

There is detachment in viewing the importance, or unimportance, of the human species, of life on this planet in general; and detachment from the passions, the hatred, the narrow prejudices of religions, nations, and classes. Nationalism is the target, not the nationalists—those misled idealists whose fervor might have been channeled to more constructive goals. Fascism is to be destroyed, root and branch, not the Italian or German people.

The book opens with a description of the universe, the galaxies, their weight in tons, their expanses in light years. Human failure up to this time becomes venial sin, like a small child's misdoings of a stormy minute, while a span of many thousand times the length behind us is yet ahead of us for redemption. For Thirring does not believe in the extinction of mankind while there is yet solar energy and, owing to it, life on this planet. The theory that civilization is a result of the overgrowth of the brain—"metaphrenia," as some sinister biologists have called it—which like all overgrowth eventually leads to the extinction of the species, is rejected sternly and convincingly.

From cosmology, Thirring leads us to a consideration of character types. Leaning, for the most part, on Kretschmer's *Körperbau und Character*, he traces the spiritual and physiological concatenations which determine the various character types and are far more decisive for human differences and affinities than the artificial grouping by nations or races. The fundamentals of psychoanalysis—Freudian slips, the meaning of dreams, neuroses, traumatic experiences, complexes, libido—are paraded in double-quick time. The author's concern with this field seems to be less direct, however, and the section strikes an unhappy medium between the level of the layman, for whom it is too tight, and that of the expert, for whom it is not tight enough.

"Occupation Perspective"

On the basis of this exposition, Thirring erects his own psychology and terminology, which we will summarize briefly.

What is it that induces the dog to run after a stone or a ball, to bring it back to his master, to beg with eyes and tail until the object be thrown again; to repeat this play until either

the dog's lungs or the master's patience is exhausted?

Originally the running and fetching was hitched to the purpose of hunting, of making a living. Later, the original purpose was dropped, and the means became an end in itself. Originally, to use another illustration, the use of pointed stones and flints was strictly linked to the making of a living; gradually the original purpose receded, and the means or tool was elaborated and adorned. Thus, playfulness is the origin of art and culture and civilization. But the same playfulness, dislodging the aim and overmagnifying the means, often is also a source of degeneracy. It creates an "occupation perspective."

"The occupation with any object can increase the space which that object occupies in our consciousness; the interest, attention, and esteem we hold for that object can be raised by the mere fact of our being occupied with it." Thus "occupation perspective," called also "foreground perspective," creates a "disproportionate assessment of value" (*Wertwachstum*). If transferred, by way of human imitativeness and conformism—the "bandwagon psychology"—from the individual to the collective, the distorted perspective causes disaster. Thus the aim, the victory of Christ, was forgotten, and murder and arson became a purpose unto itself in the most unchristian religious wars, inquisitions, and witchhunts. Thus an economic aim, even though rationally conceived, cannot remain a guiding factor in a war that engulfs the whole economy, means and end.

The latter point is illustrated by the financial balance drawn from a hypothetical third world war fought for the sake of the Iranian oil wells. It is well known, the author reminds us, that raw oil, Diesel oil, gasoline, in other words practically all the products of petrol, can be produced synthetically by a process of liquifying coal. Now, the U.S. as well as the USSR each possesses coal deposits which would enable either one to produce more oil than is available in the whole Middle East. The costs involved in setting up plants for this production may be estimated somewhere around $100 million, while the annual budget for the armed forces of the U.S. is (or was!) around 20 billion and the costs of a new war would amount to several 100 billions. To try to secure the possession of Iranian oil by means of war would be tantamount to paying the price a thousandfold.

Historical and Political Analysis

The second volume applies the concepts of the first to a historical and political analysis of past and present. The idols of "folk" and "living space" are broken. Colonialism and nationalism are exposed as products of "disproportionate value assessment" and "delayed adaptation." This latter—another of the Thirring terms—describes the result of "occupation perspective" applied to "institutions"; or human, especially collective, *inertia* which makes men hold on to institutions, once useful, though in changed circumstances they may have not only lost their usefulness, but become obstacles, dangers, absurdities.

Vernunft wird Unsinn, Wohltat Plage,
Weh dir, dass du ein Enkel bist!

The history of national socialism is surveyed, and the roots of German nationalism are traced to a mid-layer of intellectual misleaders. Thirring makes his accounts with Fichte, Nietzsche, Sombart, and Spengler. Fichte is taken to book for a passage, in his "Addresses to the German Nation," in which he emphasizes the mystical unifying qualities of language in general and the German language in particular. Thirring doesn't like Fichte's language. "Notwithstanding the so-called bonds of common blood and common language, I refuse emphatically to consider myself related in any way to a man who thinks so unclearly and writes so unintelligibly."

Nietzsche gets no less rigorous treatment: a misfit and weakling who craves the grandeur and strength of a superman. Thirring's argument is weakened, however, by the fact that the passages most heavily indicted are culled from the writings of Elisabeth Förster-Nietzsche rather than from the philosopher's work directly; and this reviewer is unable to understand how a man whose soul is capable of feelings of sublimation or "transfiguration" when listening to Wagner's music—as Thirring confesses, and proudly so, on several occasions—can be so totally blind to the greatness, the sublimity of Nietzsche's experience and art. Wagner's philosophy and politics are no sounder than Nietzsche's. Both are equally vulnerable to criticism; and both have contributed equally to the glamor of the "unculture" of the Third Reich.

On the whole, Thirring's analysis of the intellectual foundations of nazism seems to us to be too German. What about Malthus and Darwin and Austen Chamberlain and Kipling, about Pareto and D'Annunzio?

It would have been more in the spirit of Thirring himself to point out that the sickness of our culture, both symptoms and sources, is not localized, but world-wide—more a sign of the era than of any one area.

From the spectacle of the rise and fall of nazism, Thirring leads us face to face with the postwar crisis. A number of pages are dedicated to the horror of atomic warfare, a topic all too familiar to American readers, but perhaps not familiar enough to Europeans who, as is well known, largely refused to buy American accounts as evidenced, for example, by the low sales figures of John Hersey's book. It may be useful for the Europeans to get the facts straight from one of

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"The Love of Excitement . . ."

"I think every big town should contain artificial waterfalls that people could descend in very fragile canoes, and they should contain bathing pools full of mechanical sharks. Any persons found advocating preventive war should be condemned to two hours a day with these ingenious monsters. More seriously, pains should be taken to provide constructive outlets for the love of excitement. Nothing in the world is more exciting than a moment of sudden discovery or invention, and many more people are capable of experiencing such moments than is sometimes thought."

—Bertrand Russell,
in "The Springs of Human Action,"
The Atlantic Monthly, March 1952

their own outstanding physicists. It cannot but strengthen the European desire for peace, if such a strengthening is necessary.

Assessment of Baruch-Lilienthal Plan

The Baruch-Lilienthal Plan is analyzed with praiseworthy objectivity both from the American and the Russian point of view. Incidentally, it seems surprising that no one has yet pointed out the similarities of approach between that plan and the Schuman Plan, both being flank attacks on the problem of supranational organization for the maintenance of peace and both implying the dangers foreseen so clearly in Burnham's *Managerial Revolution;* The Schuman Plan, with its political, federalist superstructure, goes much farther in facing and averting these dangers, and, in the present situation, it will probably stand or fall with the possibility of a full political federation of Europe. No such federation including Russia and the United States is in sight yet, although it may be around the corner. Hence the flank attack, strategically unsupported, was doomed to failure.

The failure of the Baruch Plan leads Thirring, in conclusion, to the advocacy of a world government program as the only alternative and as the natural and rational end of the social, economic, and political evolution of this century. This concluding section opens with a summary of Emery Reves' *Anatomy of Peace,* and reviews the history of the world government movements during the postwar years, singling out the Chicago Committee to Frame a World Constitution, the international World Movement for World Federal Government, the British Crusade for a Peoples' World Convention, and the stirring adventure of the World Citizen, Garry Davis.

The quintessence of the whole work is that war can and must be abolished. It is neither a historic or economic necessity, nor is it psychologically inherent in man's nature; for "modern war has absolutely nothing to do with the fighting impulse of the individual but is the baneful consequence of the maintenance of outdated institutions." It is not man's nature that has to be changed (that would be a difficult job indeed), but man-made institutions that have to be adjusted to abolish war. Not a moral conversion of the species, but intellectual enlightenment is all that is necessary, and it should be undertaken consciously, systematically, and without delay.

Future of Peace Movements

The author sees two immediate tasks ahead.

First, the peace and world government movements, which have remained marginal so far, must become popular movements, penetrating the masses of workingmen, professional men, churchgoers, members of civic organizations, etc. Thirring seems inclined to see the center of gravity of such a world-wide movement for peace in the countries which are neither American nor Russian and whose most direct concern would seem to be to avert a clash between the two giants, in which they would be the first to be crushed. He furthermore suggests that the cells of such a movement should be found in the growing world community of international nongovernmental organizations (trade unions, chambers of commerce, Red Cross, YMCA's, etc). Each of these organizations has an interest in peace, on which its very existence depends. Most of them expend a great deal of time and money upon the study of world political questions and the elaboration of recommendations. Taken separately, however, each organization is too weak to exert any sizable influence on world developments. Jointly, these organizations, representing today some 300 million individuals all over the world, could constitute a formidable force for peace.

A suggestion similar to Thirring's was recently launched by members of the three Scandinavian parliaments and is beginning to arouse interest in other circles. In the past, revolutionary ideas, like democracy or communism, became the hope, or the scourge, of the world when embodied by a great nation, as happened, for example, after the French Revolution or the Russian Revolution. It is not likely that any one powerful nation will become the standard-bearer of a democratic, socially and economically progressive world government program. It is not impossible that the world community of people, taking shape around the catalyst of the international nongovernmental organizations, may take over that role which at one time was reserved for the national community.

Reform of the Educational System

The second immediate task, according to Thirring, is a reform of the educational system, to be undertaken, preferably, by Unesco and to be carried out on a world-wide scale. The teaching of history is the first and foremost item in need of such reform.

In addition, a new discipline should be introduced in the curriculum of all institutions of middle and higher education; namely, the understanding and improvement of human relations. Education in this field should "awaken the will and wisdom which will enable man to understand his neighbor to the extent that he can fit himself harmoniously and without unnecessary friction into the wheelwork of human society." As a textbook for instruction in this discipline, the author recommends, without making any bones about it, his own work, to be supplemented by a reading list including Roger Williams' *The Human Frontier,* Aldous Huxley's *Ends and Means,* and Egon Fenz's *Human Relations.* To the question of whether it will be possible to reform mankind

"The Improvement of the Art of War"

"It is deeply to be regretted that another and most unworthy object has been introduced and has gradually and alarmingly increased in prominence. This is the improvement of the art of war and the implements of mutual destruction. I know there are those who think that these improvements will tend to put an end to war by making it more destructive. I cannot think that such an opinion is based on common sense. I believe that war will not only be more destructive, but be carried on with greater ferocity. And thus by applying itself to an improper object science may eventually fall by its own hand. . . ."

—James Prescott Joule
(1818–1889)

by way of education within the necessarily short time of, say, one generation, Thirring answers unqualifiedly and emphatically, Yes.

An Optimistic View of Mankind

Thirring is throughout an optimist. Optimistic is his view of mankind as a young species, with a long span of life ahead for self-improvement and maturation. Optimistic is his moral estimate of mankind, his constant rejection of evil as a potent factor in history. It is not the evil ones, according to him, but the misguided, the unenlightened, who have caused misfortunes in the past. Optimistic, finally, is his faith in the irresistible force of reason and his trust in education.

In an epoch of cynicism and despair such optimism is not only refreshing; it is essential and necessary. It is tragic, however, that so often in history the optimists were, relatively speaking, superficial; and profundity in considering reality as it is has been more often deployed on the reactionary and pessimistic side. Despite his broad culture and his solid scientific background, Thirring's optimism occasionally shows the hallmarks of superficiality and oversimplification which characterize the history of optimism.

Thus his emphasis on education, or rather, on bookish education, based on a select reading list and allotted a certain, very low percentage of time in the general curriculum, is unrealistic. Human relations cannot be taught by books alone, and whether education as such can transform any society in the course of one generation or of ten is a moot question, since it is the society that determines the nature of its education, and the one is but an aspect of the other.

The history of these last thirty years seems to indicate clearly enough that a society *can* be transformed within the span of a generation or less. The beastly S.S. man and the blindly fanatical Communist are products of only a few years; and "education" certainly had its share in this process. It was, however, not education alone, but education in the frame of a changed way of life and changed political institutions that did the trick. Education in human relations and education in world citizenship may be necessary. It will not be effective, however; it will not even be introduced in the way desired by Thirring before much wider reforms than those in the educational field will have taken place.

The separation between "institution" and "nature," between what is and what is not, and need not be, subject to change through learning, seems to be too schematic. Learning, it is true, can be inculcated. But what about the will to learn? The force of enlightenment is not irresistible, and the irrational, negative, and self-destructive forces of human groups will not be conquered by reasonable books alone.

The hard and fast separation between a community's "culture," on the one hand, and its political history (wars, conquests, etc.), on the other, also seems overschematic. To return to the Thirring myth told in the opening paragraph of this review: How could one imagine the flowering of Athenian art, or of Roman civilization, or of occidental science, without the statesmen and armies that created its "living space"? It cannot be sheer casual coincidence that the great *Kulturvölker,* the bearers of science and progress, have, at one time or another, also produced great statesmen and generals. One need not indulge in a glorification of nationalism and militarism or a minimization of the epoch-making importance and universal character of modern science in order to state that a history which, retrospectively, would eliminate consideration of a factor of culture as important as the factor of statesmanship and the rise and fall of empires and commonwealths would be no history at all.

But these are criticisms of detail. They do not detract from the admiration for the moral earnestness and the wisdom of this work. They do not detract from the desire to see it translated into English, even though perhaps in a condensed form, omitting those sections with which American readers might be more familiar than Europeans.

—Elizabeth Mann Borgese

Senator McMahon

(*Continued from page 170*)

to make proposals that caused some to call him a naive idealist or a global boon-doggler.

In a Senate speech on February 2, 1950 (reprinted in the *Bulletin* in March 1950), Senator McMahon proposed that the United States invite all nations to reduce their military budget by two-thirds and contribute the savings to a cooperative program for raising the standard of life in underdeveloped areas of the world. This would mean an annual commitment of $10 billion by the United States over a five-year period: the sum appeared to many preposterously high. More recently, in a speech delivered by wire from his hospital bed (reprinted elsewhere in this issue of the *Bulletin*), Senator McMahon repeated his proposal; but this time he spoke of an even larger sum—the American military budget having climbed, in the meantime, from $15 to over $50 billions.

Senator McMahon was in full agreement with the Marshall Plan, the Point Four program, and the Atlantic Pact; but all this seemed to him not enough. He wanted America to assume a more effective and more inspiring leadership in the fight for world peace and world cooperation. He believed that the failure of the United Nations plan for the international control of atomic energy to win Soviet support, called for still bolder and more imaginative diplomatic, economic and spiritual endeavors.

In the same spirit, Senator McMahon was eager for America to make a much greater effort to reach the Russian people, and to carry to them the message of American goodwill. He was the author of the resolution (unanimously adopted by Senate and House), expressing friendship for the Russian people, which President Truman transmitted to the Soviet government.

Our recent political conventions have demonstrated that America is not devoid of leaders of high character with brilliant political and administrative abilities.

Senator McMahon was, however, more than just one of this new generation of political leaders. His was a unique vision and a unique dedication. He leaves an empty place in American political life. The loss is not only to America but to all mankind.

—E. R.

Strangely Beautiful . . .

Among the press observers at one of the Nevada tests last May was a Business Week *reporter who gives this record of what he saw. We thank the editors of* Business Week *for their kind permission to reprint this story.*

IT WOULD be easy—and many newspaper writers reaching for an angle succumbed to the temptation to draw ironic contrasts; between the mass-production glamor of Las Vegas' resort hotels and gambling casinos and the grim, unspectacular geography of the test site. Yucca Flat is a 20-mile saucer in the mountains. Low red and black hills, cindery and lifeless, rim an almost dead-flat plain of yellow gravel hazed with the gray-green of scattered sagebrush. At one side of the saucer is a glittery, paved-looking expanse of baked clay, the dry bed of a seasonal lake.

Hardly anything else is visible under the glaring Nevada sun—just the low, windowless blockhouses of the control center at one edge of the saucer; on the mudflat, tiny in the distance, a clump of army shacks, trucks, and helicopters; in a couple of places, barely visible, the wispy steel towers on the top of which more elaborate test bombs will be set off later this spring.

It would be easy to be ironic, too, about the contrast between the apocalyptic connotations of the atom bomb and the almost comically elaborate technical arrangements for press coverage, for communicating the incommunicable with the utmost rapidity. Trestle tables where reporters could beat their typewriters as they watched the explosion were in place on the sloping sides of a solitary outcrop. Twelve army teleytpe machines were lined up beside the tables to microwave copy from the typewriters into Las Vegas. Behind were more trestle tables for the heavy tape recorders of the radiomen. Further up the hillside were more radiomen with portable recorders slung over their shoulders and something like half a million dollars worth of photographic equipment.

Dominating everything at the very top of the hill was one of station KTLA's four television pickup cameras. The special arrangements needed to provide a somewhat smudgy and unexciting television picture direct from the site had been almost heroic.

Actually, there's little justice to any of these ironies.

For the outstanding impression from first-hand observation of the explosion of an atomic bomb is this: How little there is in it of the horror and shock its historic importance would lead you to expect, how much of sheer breathtaking beauty and magnificence.

All the terror is in the 60 waiting seconds before the blast. The fleecy vapor trail of the drop plane making its bombing run at 30,000 feet is already visible in the sky when the loudspeakers up the hillside announce: "H hour minus one minute. Put on dark glasses." You put on the goggles—thick reddish ones that leave you feeling completely blind in the brilliant sunlight. You look up toward your right to where you know the sun is, find it—a silvery disc looking like a bright moon. You turn your head back again to where the bomb should burst.

The speaker says, "Thirty seconds. For God's sake, keep those goggles on." You realize your heart is pounding fiercely and one leg, the weight unbalanced, is shaking uncontrollably. In the foxholes, five miles forward, the soldiers are crouched low, shielding their heads with their arms.

The speaker says, "Bomb away." That signal came from the plane itself, by radio to the control blockhouse, by telephone to the observation site. In the control center, the same signal set going an intricate timing apparatus, which, in preset sequence, began setting up circuits, turning power into geiger counters, pressure gauges, temperature gauges, oscilloscopes, automatic cameras, rocket-firing apparatus, closed circuit TV pickups, amplifiers all over the proving ground, many of them in massive concrete bunkers directly under the bomb burst.

The bomb is in the air now, falling. The speaker says, "Twenty seconds."

The speaker says, "Ten seconds."

The speaker says, "Five . . . four . . . three . . . two . . . one . . . ." There is an interminable pause.

Then, through the heavy goggles, the whole world becomes an intense, dazzling brightness centering in an amorphous disc bigger and many, many times brighter than the moony sun you had looked at a minute earlier.

At the same instant, you feel a wave of heat against your face—like the feeling on your face when you open the door of a hot kitchern oven. You start counting to yourself, "One thousand and one, one thousand and two, one thousand and three," while the brightness hardly diminishes. Then you take off your goggles and look.

The first thing you see is the vertical trails of the rockets, which streaked upward just before the blast to lay a grid of smoke trails.

Just as you take off your goggles, the shock wave strikes at Ground Zero, tossing and destroying, you know, the planes and trucks parked there, if they haven't already been vaporized by the heat. What you see

from ten miles away is a wall of dust, rising slowly into the air and streaking sideways along the ground as the shock wave travels.

You look into the air, up where the bomb burst. Hanging there, roughtly the shape and about half the apparent size of a fist held at arms's length against the sky, is a dense cloud. Out of the corner of your eye you had seen it glowing a dull red; now, as you look, it fades to a woolly dirty grey. If there had been a city instead of sagebrush below that cloud, you realize later, half a million people might be dead or dying at this instant. But that's not what you think at the time. You think, fleetingly, "Is that all?" and then you suck in your breath and hold it because . . .

Welling up from the center of the cloud and spilling in easy liesurely magnificence down the side comes a wave of glowing pink foam. And welling up behind it and flowing over it comes a second wave of shining heartbreaking whiteness. . . .

You let your breath out as the speaker says, "Here comes the shock." You brace yourself, put your fingers over your ears. In the foxholes fifteen seconds earlier, the soldiers had been tossed backward, tossed forward again, as the primary and secondary shock waves reached them. But when it reaches you, the shock is nothing but a sound and not a very impressive one. A sharp report, like a revolver fired at close range, then a lower and louder rumble lasting for seconds, and it's gone. You become conscious of the other noises around you, the whir and clatter of the movie and still cameras, the confused babble of the radiomen, who are talking hysterically to their recorders.

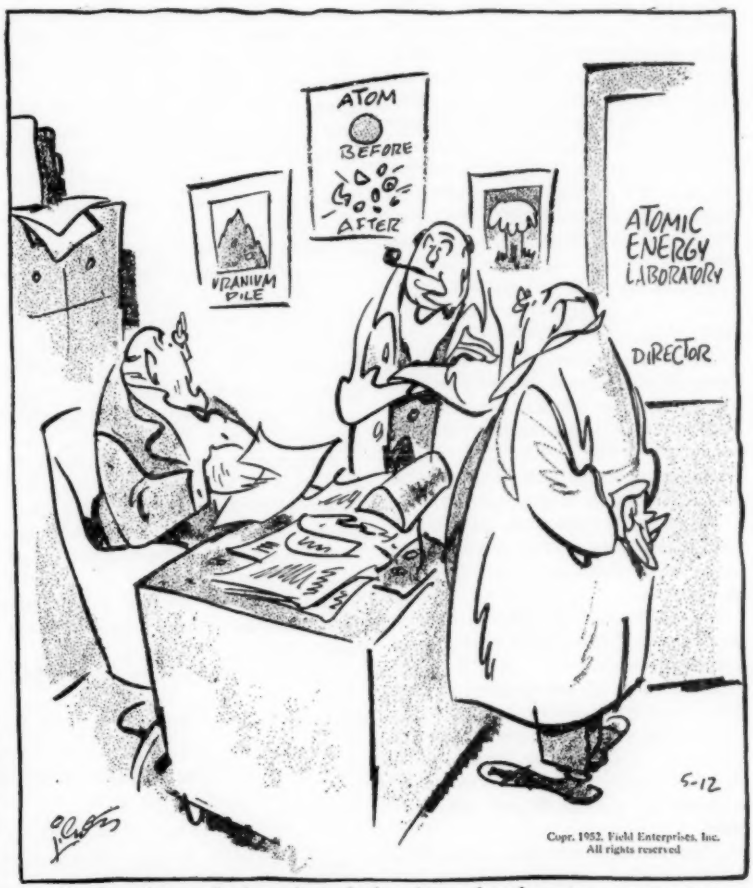
From a military point of view, by now the blast is over, the damage done. The picked radiological corps men climb out of their foxholes and start moving forward toward Ground Zero, sniffing their way with geiger counters as they go.

But back at the observation site, you relax your muscles and sit down on a rock to watch the powerful, inexorable, and beautiful unfolding of the cloud structure. The glowing pink and the shining white have now flown completely over the sides of the cloud, obscuring the grey. They coil around the underside and then—leisurely, amazingly—follow upward into the center of the cloud. As this motion establishes itself, the cloud assumes a precise miles-wide structure, a huge doughnut ring, rotating downward on the outside, upward through the center, in layers of white and pink—and rising rapidly through the air.

Now a new phenomenon develops. A black coil of dust starts rising from the dustwall on the desert floor reaching diagonally up toward the looming shining doughnut-shape. Midway between the two another stem cloud appears, this one white, twisted, and streaked with sulfurous yellow. It grows, for minutes, upward toward the doughnut, downward toward the dust; but it never quite reaches either. There is never any mushroom shape. Finally, both stem clouds disappear, and only the glowing, coiling doughnut remains.

By now half an hour has passed. The tension is gone. The military brass have helicoptered back from the foxholes to be interviewed and photographed. The radiological teams are most of the way into the bombed area (55 minutes after the blast, they reach Ground Zero, radio for the troops to come on in). The paratroops are taking off in DC-3s from the mudflats. The radiomen are listening to their tapes read back what they had said about the explosions. Observers are lining up at a mess truck for coffee and sandwiches. An army jet fighter streaks away carrying TV film to Los Angeles to be put on the transcontinental cable.

Gradually, the observers start drifting back to the buses that will take them into Las Vegas. Most are subdued, calm. To at least one of them, it seemed that 2,000 miles of travel and four days of time had not given him any very significant information about weapons, but had given him a chance to see one of the most strangely beautiful of human creations.



"I thought we had perfected the Atom bomb, men . . . now, we are asked to make one that will televise better . . "

Courtesy of George Lichty and the Chicago *Sun-Times*

Civil Defense and the Nevada Tests

FRANK P. ZEIDLER

Mr. Zeidler, mayor of Milwaukee, Wisconsin, heads a vigorous municipal defense program.—ED.

AS ONE of those who saw the atomic test of April 22 at Las Vegas, I have been interested in getting the reaction of the public. The reaction of the public is an important factor in building a civil defense program that will actually prevent casualties and not provide rescue services only.

As of this moment, I should judge that there are few measurable effects of this test in America. In this observation I am confirmed by the opinion of John Butler, mayor of San Diego, California. Mayor Butler believes that the test, the accompanying television show, and pictures, might have laid the groundwork for panic in American cities.

This is my observation also.

Inertia in Civil Defense

There are no concerted efforts on the part of cities to depart from the inertia of their ways. The same old building codes permitting wooden construction, the same emphasis on glass, the same pattern of congestion prevails in modern city growth.

Builders and real estate people, investment houses, and others, continue to act as if they never heard of the atom bomb.

The politician who takes too much cognizance of it may be regarded as a little cracked.

The inertia of our present system with respect to the existence of the atom bomb was not overcome by the test of April 22, partly because of a lack of a visible yardstick by which to measure the effects of this particular burst.

The locus of the burst contained geographic features on a grand scale—a big desert, long distance views, and 8,000-foot ranges. Thus, when one looked at the boiling desert below ground-zero, the fact that the dust cloud rose a mile was lost against the other grand-scale features.

The human mind apparently cannot translate an atom air burst over a desert into the indescribable effects of the same burst over a city. The human mind cannot translate a dust column over a desert into a dust column over a city containing, among other things, the vaporized elements of human beings and their works.

Rodney Q. Selby, civil defense director of the state of Iowa, took a series of color photographs of the air burst which show clearly the pattern of the dust plume in relation to the mushroom. Although the plume is about a mile high, yet its significance is lost by comparison with the more spectacular mushroom.

The pictures were published in the *Des Moines Sunday Register* on May 18, 1952.

Partly to overcome this problem of helping the people of Milwaukee realize what such a burst would do to their city, I wrote an "Observer's Report," giving a general account of the effect on the city by reciting damage in terms of distance to the main street of the city and in terms of square miles.

This report I sent to members of the civil defense organization, the press, city and county department heads, members of the state legislature, members of the Congress, and other persons.

The response to this report has been excellent, with these policy-making individuals.

Our local civil defense organization also has secured new courage to request that certain actions be incorporated in public policy.

The Test and the Soviet Union

I have said that there seem to have been few measurable American reactions to the civil defense tests of April 22.

There are probably more Soviet Union results. I am sure that observers for the Soviet Union must be studying and analyzing every single scrap of information on nuclear fission, especially of this test.

They probably are studying it with two principal questions in mind: How destructive is this weapon? Should the Soviet Union strike now before civil defense in America gets set?

To one such as myself, remote from the Soviet Union, it seems that that unhappy country is seized by a kind of political religion which has as its main article of faith the proposition that all the world means ill toward them. Therefore, the Soviet Union must strike outward. Anyone who does not subscribe to this position is dangerous to the state and must be liquidated.

Thus the Soviet system appears to have no internal check in it which can prevent it from aggressive warfare. In this pattern, the present Soviet Union resembles the Hitler system which also based its reason for existence on the need to quarrel continually with practically everybody.

Until such time as a more sensible attitude will prevail in the Soviet Union, we will need the best civil defense system we can supply.

Who's Afraid of the Big Bad Bomb?

"If all the school children in the nation could witness an A-bomb blast, it would do much to destroy the fear and uncertainty which now exist."

—ATOMIC ENERGY COMMISSION SPOKESMAN
quoted in *Scientific American*,
June, p. 19

Thirring: Uranium for Power?

(*Continued from page 171*)

us assume that after a gradual growth nuclear power production will stabilize itself at a level where 30 per cent of total electric energy produced will be derived from uranium fission. This means that 10 per cent of the total fuel consumed in the world will be nuclear fuel. At the present rate, this means a yearly world-wide consumption of 2 x 10^5 pounds or 100 tons of uranium. The estimation of the total available world resources of uranium depends largely on what is considered "available." Of course, uranium is a very common element, but only a tiny fraction of it is present in ores which are concentrated enough to warrant economic use. Glasstone writes as follows:

> According to estimates made by geologists, uranium is present to the extent of four parts per million in the earth's crust, while the concentration of thorium is nearly three times as great. At this rate, a total of nearly 10^{17} pounds of fertile material, from the standpoint of atomic energy, is present in a three-mile deep layer of the earth's crust. These figures imply that uranium and thorium are not at all rare elements, and that they should be as plentiful as zinc, lead and tin, and much more common than mercury, silver and gold. However, such an approach in estimating reserves is meaningless, except to indicate that uranium and thorium are present in the earth's crust in important amounts. While most of the familiar metals occur in relatively concentrated forms in well segregated ores, uranium and thorium are so widely distributed that significant concentrations, in workable deposits, are the exception rather than the rule. . . .[3]

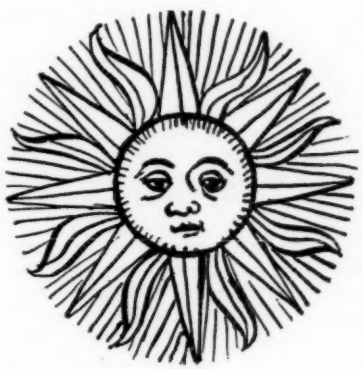
Let us then take double the amount given as correct; this means that 2 x 10^8 pounds or 100,000 metric tons of uranium are available in economically useful ores. We have to consider, however, that in the first place the total power consumption on earth is likely to grow by a factor of 10 or 100; and, in the second place, that once the use of atomic power has become routine, its share in total energy production may well rise above the above-assumed 10 per cent.

In this way in a few centuries man will have squandered this unique and literally irreplaceable gift of God, and in the subsequent millions of centuries in which he will probably have learned of ways to do much more exciting things with atomic energy, he will have to resort to extremely expensive processes to obtain uranium from poorer sources. As an example of the high costs of utilization of low-grade deposits, we quote the following statement of Gordon Dean, chairman of the U.S. Atomic Energy Commission:

> Two scientists, several years ago, calculated that to obtain uranium from sea water at a rate of 100 tons a year—enough to make it an interesting source—we would need a plant capable of processing 12 million tons of sea water per hour, and the cost of such a plant was estimated at in the neighborhood of 150 *billion* dollars.[4]

Untapped Water Power Resources

Can we then take upon ourselves the responsibility for a decision, which will lead within a dozen generations, to the depletion of all high-grade uranium sources—at a time in the history of science when the field of nuclear chemistry is still in its swaddling clothes? Of course, we need more industrial power in the world—tomorrow



ten times as much, and the day after tomorrow, perhaps a hundred times what we use now. However, all this energy can be obtained with approximately the same investment costs and probably with smaller operation costs, in many other ways! First of all, only a small fraction of water power that is available on earth is being used now. Great installations such as the pioneer TVA can be created in many other parts of the American continent. The hydraulic power projects planned in Russia already have ten times the capacity of the TVA plants. In the border area of France, Italy, and Switzerland an annual energy production of 32 billion kw-h. could become available through the completion of the great Val d'Isére project. The water power resources of Austria could yield 30 billion kw-h. annually upon complete development, while only 5 or 6 billion kw-h. are produced now. We do not need even to mention the giant and perhaps hardly realizable projects such as the Gibraltar Dam, or similar schemes.

Solar Radiation

Besides the water power works, which utilize solar energy indirectly, there are other direct—or other indirect—ways of using solar radiation, which will remain practically inexhaustible for the next billions of years. The reason why these possibilities have not yet been practically exploited probably lies mainly in the fact that they could be utilized only in combination with energy storage facilities of large capacity, and that the construction of the latter adds to the required investment. This applies to the utilization of tides, to wind-driven energy generators, and also to heat engines operating with solar heat.

The example of the Manhattan project shows however that billion-dollar investment, made apparently *à fond perdu*, can pay off in an amazing way; and this has made us more willing than ever to make such investment. If costs are no object in the planning and building of atomic power stations, the same should be the case for comparable projects utilizing, for example, the direct conversion of solar energy. When power is the primary aim and not nuclear-chemical transformations, both types of development deserve trial. The possibility of solar heating for domestic use was recently discussed in the *Bulletin*. Large-scale energy production through steam power generators whose boilers are replaced by thousands of pipes laid along the focal lines of cylindrical mirrors deserves of equal attention. Such installations should be built and tried out in practice in conjunction with appropriate energy storage reservoirs. The latter could be thermal (steam storage bins), electrochemical (storage batteries), or mechanical (pumping stations). Reservoirs into which water is pumped to provide power reserve are

[3] Samuel Glasstone, *Sourcebook on Atomic Energy* (New York: Van Nostrand, 1950), p. 406.

[4] *Bulletin of the Atomic Scientists*, VII (1951), 186.

routine installations in many places and have been operated with a satisfactory utilization coefficient.

An area of a square meter, on which solar radiation falls vertically, receives around 1.3 kw. per second. This shows that one square mile of mirrors placed in a region of low cloudiness, 40 or less degrees away from the equator, could deliver about 1 billion kw-h. of energy annually, assuming 75 per cent coverage of the ground, a mirror and boiler efficiency of only 60 per cent, and a thermal efficiency (for the conversion of heat to power) of 35 per cent. The construction costs will undoubtedly be higher than with conventional boilers, but perhaps not much higher than with atomic power plant. In the U.N. Atomic Energy Committee report on September 7, 1946, the costs of a power plant with 75,000 kw. production capacity, "in a normal locality in the Eastern U.S." were estimated as follows: Atomic Power Plant: $25 million; Coal-Steam Plant: $10 million (today's estimates would have to be higher).

It remains to be investigated whether an investment of $15 million (or a little more) would suffice to install 0.8 square kilometers of collecting mirrors; and what would be the cost of the associated energy storage facilities. Solar power stations, like water power stations, have this advantage: once the building costs have been amortized, they can continue operating at exceedingly low cost, since their fuel consumption is exactly zero.

Only if the direct or indirect utilization of solar energy should prove to be fraught with insuperable difficulties, and the full utilization of water power resources should prove insufficient to cover mankind's power requirements, could the resulting power shortage justify touching the unique heaven-sent treasure trove of fissionable materials for fuel.

Dixi et salvavi animam meam.

Queen Juliana: Universality of the Sciences

(*Continued from page 172*)

that rule the world, not the mind, however much the mind may think it does.

And so we can rediscover the species of man to which we belong, badly deformed though it may be.

In the last two generations—and a long history of development precedes it—many new notions, thoughts, and feelings have come to the fore, which cannot be anything but the forerunners of better times. I feel that you may all be pioneers in this great field of rediscovery, and I feel confidence in your ability to go far in that direction. Is there anyone then who could really believe in a drab and dreary end for mankind as inglorious dust?

The Rediscovery of Man

I think, that we are, on the whole, beginning to rediscover man, in his totality.

The human being is not a collection of loosely connected sections—man is one whole creature.

The same applies to human society; it is essentially one unity.

Look around you attentively for the signs, and I think you will agree that this notion is growing.

Personally, I see it gaining momentum, here and there and everywhere.

When every man and woman regains the notion of being *somebody*, each a unique personality, like nobody else, each with a task toward society, then we will be on the right path.

Their task is not alone to repeat, to reproduce, not even to invent, but to be inspired and create with their whole being.

I do not mean that everybody must be a creative genius in the ordinary sense, but it can be given to everybody to be a genius in handling the given circumstances and possibilities of his or her own life. We all can have faith in life, when listening to this inner calling I mentioned.

Then democratic society will be much stronger. It will be much better armed against every sort of menace. If it consists of members, invested with the dignity of the human being, it could itself gain dignity.

And why not have more creative genius, in science, in art, in general, in everything that makes life?

Let us not depend too much upon our own already acquired cultural values, or upon those of others, however inspiring, but let us each produce, create our unique living national treasure, that is our very own and quite new.

The creativeness of people and of peoples is what makes humanity.

Our time is a crucial one, but I believe we are on the threshold of a new and richer era.

The bird, Phoenix, of the myth, died in flames, while in her nest lay the fiery egg of the new one, ready to start her new life and spread her wings. It is my earnest wish and trust, that our new era will have learned by past mistakes and like the young Phoenix will take flight, higher than ever before, covering a greater range of earth and heaven.

Gantt: Soviet Physiology

(*Continued from page 189*)

Marxism in reality (though not openly in words) has been superseded by Russian nationalism. This nationalism has been aided in its development by outside pressures (formerly Germany and Japan). More recently, the Western democracies, in order to meet the threat of this expanding nationalism only fully apparent to them after World War II, have themselves intensified the Russian nationalistic spirit by their efforts to repress it. External wars and invasions of Russia (Napoleon, Hitler), though very destructive, have only stimulated the unity and the national spirit which we now see so clearly expressed even in science.

Seeing their errors so plainly, we should not be guilty of falling into the same morass. As our government becomes itself a director of research, the Russian example may serve the purpose of indicating pitfalls ahead for us. Neither should we underestimate the scientific contributions from Russia. It behooves us now more than ever to weigh their work objectively, to take account of their important achievements, and to be sure that while we complain of their yielding to authority and their adulteration of science with politics, that we learn from their errors—and that during the next difficult years ahead we preserve a scientific objectivity and clarity of thinking which has characterized the world scientists from Galileo and Newton to Pavlov and Einstein.

News and Notes

American Developments in Atomic Energy

The Nautilus.—The keel plate of the USS Nautilus, the first atomic-powered submarine, was laid at Groton, Connecticut, on June 14. President Truman, speaking at the dedication ceremonies, disclosed that the power plant of the Nautilus is beyond the paper planning stage and that "the Atomic Energy Commission and the Navy . . . have built a submarine hull on dry land at Arco, Idaho. They are putting into it a full-size, working engine, complete in all respects—the same kind of engine that will be used in this ship. That engine on dry land is almost complete now. Soon they will start it runnning and give it the most thorough tests."

Though Mr. Truman stressed the military significance of the new submarine, such as her ability to stay under water indefinitely and her underwater speed in excess of 20 knots, he stated his hope that this first atomic submarine would never have an enemy to fight.

"The peaceful significance of this vessel is even more breathtaking. When the ship has been built and operated, controllable atomic power will have been demonstrated on a substantial scale.

"Now we will have a working power plant for peace. This vessel is the forerunner of atomic-powered merchant ships and airplanes, of atomic power plants producing electricity for factories, farms, and homes."

Gordon Dean, the chairman of the U.S. Atomic Energy Commission, joined the President in predicting that the successful completion of the Nautilus would mark the beginning of a new era, not only in naval warfare, but in the history of mankind, with enormous implications both for defense and for human welfare.

Mr. Dean also hailed the atomic submarine as an important concrete example of the kind of things that can be accomplished through a cooperative effort by scientists, industry, military men, and a civilian government agency.

The Argonne National Laboratory announced on the dedication day that work on the design and development of the nuclear-powered submarine was begun in early 1948 with the creation of a Naval Reactor Division and with the construction by Westinghouse at Arco of a land-based prototype of the nuclear reactor.

To meet Navy specifications, Argonne selected a reactor using uranium as fuel and high-pressure, high-temperature water as the heat exchange medium for transferring nuclear heat to the boiler of the steam turbine propulsion plant. As design work advanced, various reactor components were constructed and tested at Argonne.

The Nautilus is not the only atomic-powered submarine under development. On February 21 of this year, the AEC authorized the General Electric Company to design and build an atomic power plant for a second ship. However, while the Nautilus is powered by a slow neutron reactor, the power plant to be built by the General Electric Company will be an intermediate neutron energy reactor.[1]

"Great Developments."—After a visit to the White House in company of Gordon Dean on June 27, Dr. Robert Oppenheimer, Chairman of the AEC General Advisory Committee[2] told reporters: "There have been such great developments in atomic energy we felt we should report on these directly to the President. We wish we could say what was in the report, but we cannot."

AEC Appropriations.—On May 29, President Truman requested of Congress an appropriation of $3,341 billions for the fiscal year 1953 to cover a major part of a five-year atomic program that would eventually cost 4.2 billions of dollars. The President outlined the program in broad terms in two letters, one to Speaker Sam Rayburn, and the other to Senator Maybank, chairman of the Subcommittee on Independent Offices of the Senate Appropriations Committee.

In the letter to the Speaker of the House, Mr. Truman stated: "This expansion has been under consideration for some time. It is made necessary by the fact that the Soviet Union has shown no disposition to cooperate in an international program for control and regulation of armaments."

In his second letter the President sought to allay congressional fears that the appropriation might be excessive, since it did not contain any detailed indication of how the money was to be spent.

However, the House remained initially unpersuaded by the President's arguments, and its Appropriations subcommittee approved the expenditure of only 1,450 billions and attached a rider which prohibited the AEC to start any specific construction project unless funds were available to complete it.

Senate objection, particularly to the House rider and to the over-all size of the House appropriation made necessary five conferences between the two Houses before the disagreement was finally resolved. On July 7, a House-Senate Conference Committee agreed to boost the AEC funds to 2,898 billions but to keep the original house rider, after AEC Chairman Gordon Dean had agreed to accept the compromise proposal.

Swimming Pool Reactor.—Development of a relatively inexpensive, low-power nuclear reactor, unique in that it is submerged in water to protect operators from radiation, was announced on May 19, by the Oak Ridge Operations Office of the AEC.

The reactor is the central feature of a bulk shield testing facility which is used for experiments to aid development of improved reactor shields. The facility is popularly known as the "swimming pool," since the reactor is submerged in a pool of water 20 feet deep, 20 feet wide, and 40 feet long, in which it can be moved about. The reactor became "critical" on December 17, 1950, and was placed in operation soon afterward.

The entire facility was constructed for less than $250,000, exclusive of fuel.

This "swimming pool" reactor has a continuous, full load power rating of 10 kilowatts, at which it produces a maximum flux, or neutron density, of approximately 100 billion thermal neutrons per square centimeter per second.

Brookhaven Cosmotron.—The cosmotron at Brookhaven National Laboratory broke its own previous record on June 10, by firing an atomic bullet with a force of 2,250,000,000 volts.

The cosmotron with later modifications may ultimately reach a peak of 3,000,000,000 electron volts.

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[1] See *Bulletin*, VIII (March 1952), 94.

[2] The appointment of the new membership of the Committee, due on July 1, had not been announced as we go to press.

Nevada Bomb Tests.—The Atomic Energy Commission ended its latest series of atomic tests at the Las Vegas testing ground on June 5th.

After the final detonation, which was the twentieth since the Yucca Flat desert was first used as a testing ground in January 1951, Mr. C. L. Tyler, AEC test manager announced: "These tests, like the two preceding series, have significantly helped the nation's atomic weapons position."

Four of the "devices," as they are called by the AEC, were set off from steel towers on the desert, and four were dropped from planes.

National Science Foundation

Grants for Travel.—Nineteen American biochemists have received travel grants from the National Science Foundation to attend the Second International Congress of Biochemistry in Paris, July 21 to July 27. Eight grants were awarded to young biochemists from a special list of 100 applicants, while the remaining eleven grants were awarded to senior biochemists selected on the basis of their contribution to research in biochemistry. In making the selections the Foundation was guided by the recommendations of an *ad hoc* committee appointed by the American Society of Biological Chemists and endorsed by the Biological Chemistry Division of the American Chemical Society.

Research Grants.—The NSF has announced approval of 29 additional research grants, totaling $263,535, in the biological and physical sciences.

This is the final group of research grants to be approved during fiscal year 1952, ending June 30, under the Foundation's program for support of basic research. During the year 98 grants were made totaling $1,181,175 and distributed to 60 institutions in 35 states and Hawaii.

Research fields included are astronomy, chemistry, developmental biology, earth sciences, engineering, environmental biology, experimental psychology, genetic biology, mathematics, microbiology, molecular biology, physics, regulatory biology, and systematic biology.

Appropriations.—The final figure for the NSF appropriation was $4,750,000.

The original amount requested by the President was $15 million. This was slashed by the House to $3.5 million. The Senate Appropriations Committee recommended $5 million.

Senator Paul Douglas, in a letter to the editor of the *Bulletin*, says: "We were able to restore only $500,000 on the Senate floor, but this was lost in conference. I greatly deplore the action which Congress has taken in connection with this appropriation."

U.N. News

Senator McMahon's suggestion that the American lead in the atomic race with the Soviet Union could be maintained only if the U.S. were willing to expend greater resources than her competitor, was backed up by the recent revelation that Andrei Vishinsky had told the three Western Powers last December in Paris that the U.S. had lost her supremacy in the atomic field.

The *Christian Science Monitor* in a copyrighted story said on June 6 that Mr. Vishinsky also warned the conferees: "The current East-West arms race, if not halted, guarantees atomic warfare."

William R. Frye, the *Monitor's* United Nations correspondent wrote further that "Mr. Vishinsky spent nearly half his time trying to persuade the Western Powers to accept a prohibition on atomic weapons. Asked to describe what effect this would have in the period before control was established, he said repeatedly that it would cause the Western Powers to cease manufacturing bombs.

"The Western delegates repeatedly protested they would have no assurance that Russia would not use this breathing spell to overcome their atomic lead."

Atomic Energy Developments Abroad

Cooperative Cosmotron.—On June 21 the European Council for Nuclear Science at the conclusion of their first meeting in Copenhagen announced plans to establish a nuclear research center in either Switzerland or Denmark and to proceed with the construction of a cosmotron with a capacity exceeding 10 billion electron volts. The project which is to be completed in six or seven years represents a cooperative venture of Denmark, France, West Germany, Italy, Belgium, the Netherlands, Switzerland, Norway, Sweden, and Yugoslavia.

Great Britain.—The first official report, describing British work at the Harwell atomic energy establishment over the past six years was released in London on May 27.[3]

The *New York Times*, in a story of the same date, commented "that the report had disappointed those who expected something more positive even within the limits of unclassified information. No specific details are disclosed about the five or six reactors now believed to be under consideration, although priority is being given to work on 'breeder' units which make more fuel than they consume. At least two plutonium piles are now operating.

"With the exception of work on electron synchrotons and linear accelerators, Britain seems to have copied American particle acceleration and not developed new ones of her own. The outstanding exception is the traveling wave linear accelerator, which requires a relatively low voltage and allows particles to 'surf-ride' on the crests of electromagnetic waves in an evacuated tube. A new machine of this type is already under consideration. It will probably be 100 yards long and develop a billion electron volts."

The *New York Times* report also found a suggestion in the report that Britain knows more about certain aspects of atomic energy than she is prepared to reveal without more encouragement from the U.S. by way of information exchanges.

In the parliamentary discussion which followed the announcement in mid-May of British atomic weapon tests to be held this summer off the northwest coast of Australia, Prime Minister Churchill had stated a similar position. Mr. Churchill, in reply to a question from a Labor member of the House had declared that the U.S. government was "prevented by existing domestic legislation from exchanging information on atomic weapons with other countries."

The Prime Minister continued, "I should, of course, be very willing to consider any proposals which the U.S. government might make for closer cooperation in the future."

Canada.—*Atomics*, a British monthly publication, announced in its June issue that two new isotopes, calcium-41 and actinium-229, with half-lives of 120,000 years and 66 min. respectively, have been produced at Chalk River in Canada.

France.—The French Executive submitted to the French legislature for approval a five-year atomic energy program. The Secretary of State for Finance who presented the 107 million dollar project to the Cabinet in June, told the press that the modest expenditure involved would make impossible any research into the realm of atomic weapons.

German Nobel Prize-Winners Protest Joliot-Curie's Charges

Five Nobel Prize-winning German scientists have joined twelve of their American colleagues in calling upon the French Nobel Prize-winner, Frederic Joliot-Curie, to withdraw his accusation that the United Nations troops in Korea are engaging in bacteriological warfare. The German scientists are: Kurt Adler, Otto Hahn, Werner Heisenberg, Max von Laue, and Adolf Windaus.

Three additional American scientists have signed the letter to Joliot-Curie, which we printed in the June issue of the *Bulletin*. They are: Edward C. Kendall, Robert A. Millikan, and Isador Isaac Rabi.

[3] This report will be reviewed in an early issue.

Letters to the Editor

DEAR SIR:

I was interested to see that you reprinted portions of the two documents given out by Pope Pius XII interpreting the attitude of the Catholic Church toward science. I do, however, wish to point out that neither of these documents represents an *ex cathedra* pronouncement. They have precisely the same significance as any pronouncement which I might make as a Catholic concerning science and religion. In both of these documents he is speaking as an individual and not *ex cathedra* as Pope of the universal church. In this respect, these two pronouncements differ fundamentally from the dogma of the Assumption put forth on November 1, 1950. If you cared to go into the historical perspectives of the three pronouncements, you would get a better meaning of the word "*ex cathedra*."

Naturally, the importance attaching to the two pronouncements on science gains importance from the position which the Pope occupies. I think I would interpret his position correctly if I said that there is no reason why a scientific civilization directed toward material ends need be sundered from a universal religious faith directed toward spiritual objectives.

Very sincerely yours,

HUGH S. TAYLOR

Frick Chemical Laboratory
Princeton University

DEAR EDITOR:

I wish to present a few comments on the article, "Science and the Catholic Church," as discussed in *Bulletin of the Atomic Scientists*, June 1952. . . .

The twin article which preceded "Science and the Catholic Church" teaches a definite philosophy. Not being a professional philosopher, I am not able to state just whose philosophy it is, but it seems to be a relative of the philosophy of David Hume insofar as the author is attempting to deny the existence of substance. The author departs from "Science" in order to become a philosopher, which is all right so long as the author is not attempting to cast a smoke screen in the name of science. The author becomes quite philosophical when he questions the meaning given to "particle," and without letting the reader know what is really meant, he proceeds to expound a philosophy which would deny the existence of substance. Such a type of reasoning is an old form which I first read in the "Popular Astronomy" while I was a student in high school in the middle "teens" of this century. There is no objection on my part to mixing science and philosophy so long as the p's and q's are clearly distinguished. . . .

The article would lead many people to think that (as evidenced in "Science and the Catholic Church") the Pope is teaching a new doctrine. . . .

Your magazine must be careful not to give out a false interpretation, as if the Pope is giving in to science as being something superior to the Church itself. . . .

Now in regard to Genesis I, II, III, in particular, I find absolutely nothing new in the pronouncements of Pius XII. The scientific examples are new (so are my own private writings on the nature of diffusions and precipitations new), but the teachings about Genesis are not new.

An examination of Genesis I will show that all three methods of interpreting the Bible are useful. The three methods of interpreting the Bible are the historical, the analogical, and etiological.

Note that in Genesis the historical sequence is not followed; for after the plants were created God then created the sun, moon, and stars. How can plants live without the sun?

Such shows that the Bible does not pretend to be a book of science at all. It is a book of religion. . . .

Refer to Wisdom XI-18 where it gives a most compact summary of the first part of Genesis as follows:—MADE THE WORLD OF MATTER WITHOUT FORM. Such a statement as it stands in the light of nature is not even good philosophy. According to Aristotle and St. Thomas Aquinas it is impossible for matter to exist without form; but the Bible states that matter existed without form. Hence it is quite evident that the Bible speaks in terms of the supernatural, which in this instance refers to the incarnation of Christ which did not happen until governments and the synagogue had declined to uselessness. Thus in the analogical sense this world really cannot exist without form, just as Aristotle taught that matter cannot exist without form.

Truly yours,

PHILIP PAUL PFEUFER, B.S.

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Portland, Oregon

Editor's Note—

A main purpose of the* Bulletin *is to serve as a forum of opinion.

Therefore the* Bulletin *invites reader's comments, not only upon its articles, but upon the current developments in science and society.

DEAR SIR:

As a Catholic educated in science and at present engaged in scientific research, I wish to congratulate you on the publication of the excerpts from the two papal documents, in your June issue. The views of Pius XII on the relations between religion and modern science are certainly worth noting. Your policy in this respect is considerably better than that of those who pretend that scientists should have nothing whatever to do with religion.

However, without commenting on the Pope's statements themselves, I wish to take exception to two of the remarks in your introduction to them. The first has to do with your reference to the doctrine of the Assumption, the second with the statement that the documents quoted are *ex cathedra*.

You refer to the doctrine of the Assumption as somehow contrary to "rationalism." Unfortunately, the meaning of this word is ambiguous; "naturalism" might have been a better choice, with perhaps less offensive connotations. At any rate, let it be noted that if it can be shown (as I think it can) that Christ proved His claim to divinity and sent a Church to teach religion, it is strictly rational to accept what that Church teaches as a matter of religion. There is nothing contrary to reason in the proposition that the Blessed Virgin's body is where her Creator wants it to be. The Catholic Church thought there was good evidence that it did not go the way of the bodies of other human beings.

As to the second point: it is simply not true that the two quoted documents are *ex cathedra* pronouncements. . . . The Church makes such definitions concerning matters of religion, not scientific theories. It may be that the future will show some of Pope Pius XII's ideas on modern cosmogony to be as wrong as the scientific views of some churchmen of Galileo's time. In neither case, however, is there an *ex cathedra* statement involved.

It is particularly desirable that your readers recognize the error involved in regarding statements of the Pope such as those quoted as attempted *ex cathedra* or infallible definitions of doctrine. Otherwise the way might be prepared for a recurrence of some of the serious misunderstandings that have marked the relations between science and religion throughout history.

Yours very truly,

JOHN S. SIEGER

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